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MacGregor (W. D.). **The Protection of Buildings and Timber against Termites.**—*Bull. For. Prod. Res.* no. 24, v+41 pp., frontis., 8 pls., 8 figs., 20 refs. London, H.M.S.O., 1950. Price 1*s*. 9*d*.

This bulletin was produced as a result of a resolution passed at the Fifth Commonwealth Entomological Conference [*R.A.E.*, A **37** 114] and consists of practical information likely to be of value in Commonwealth countries. The first chapter deals with the life-history of termites, considered as earth-dwelling and wood-dwelling species, the organisation of termite colonies and the feeding habits of termites, emphasis being laid on aspects that affect control. The four remaining chapters are devoted to methods of preventing and controlling infestation of timber in buildings. The preventive measures considered include the eradication of termites from building sites by ground treatments and by treatment of mounds, for which smokes of DDT or benzene hexachloride have recently shown promise in South Africa [**39** 414], the use of naturally resistant timber or timber treated with preservatives, the most effective of which and the methods by which they are applied are reviewed, and constructional methods incorporating the use of termite barriers round buildings, these being in the form of sheet-metal strips, or, preferably, of concrete slabs, which are dealt with in some detail, projecting externally round the building and continuous or not with concrete floors. The use of resistant or treated timber is the only protective measure effective against dry-wood termites. Methods of eradicating existing infestation are considered more briefly. The appendices comprise lists of timbers reported to be resistant to termites in various parts of the Commonwealth, with their scientific and popular names, and directions for collecting and despatching termites for identification, and there is a selected bibliography of works on termite control published mainly since 1940.

Hering (E. M.). **Biology of the Leaf Miners.**—9¾×6¼ ins., iv+420 pp., 2 pls. (1 col.), 180 figs., 74 pp. refs. The Hague, W. Junk, 1951. Price *Fl.* 36.

In this book, a comprehensive account is given of the general biology of insect larvae that feed by mining in the leaves of plants, based largely on work in Europe. The information on the mines includes descriptions of their structure, a classification based on shape and a discussion of their relation to mines in other parts of the plant. General descriptions of the immature stages of leaf-mining insects of the four orders chiefly involved and of the mines characteristic of them are given in one chapter, another deals with adaptations in larval morphology related to the specialised habitat, a third with the general life-history of leaf-mining insects, and others with individual aspects of behaviour and development, including the disposal of frass, migration from leaf to leaf, the selection of plant tissues, organs and species for food, changes in the feeding habits that occur normally during development or in response to abnormal conditions, competition between larvae occupying the same leaf, and the extent to which climatic and other factors effect development. Separate chapters are devoted to larvae that mine in leaves during only part of their development or that make mines of different shapes at different stages, case-bearing larvae that also mine, and larvae that mine in aquatic plants, and there is also one on the natural enemies of leaf-miners. The colour and growth changes induced in mined leaves are described, the changes that occur in the mines after the larvae have left them are discussed, and a general account is given of the economic importance of leaf-miners. Instructions are included for collecting and preserving leaf mines and for breeding and identifying leaf-miners, and the lines along which future research is desirable are indicated.

BODENHEIMER (F. S.). **Citrus Entomology in the Middle East with special References to Egypt, Iran, Irak, Palestine, Syria, Turkey.**—10¾×7¾ ins., xii+663 pp., 43 pls., 154 figs., many refs. The Hague, W. Junk, 1951. Price *Fl.* 56.

This comprehensive survey of the insect and other fauna of *Citrus* groves in the Middle East deals largely with conditions in Palestine (Israel) and contains much data of value in the investigation of the factors causing fluctuations in populations, as well as a considerable amount of information of less specialised interest. It is based on original observations and research over a period of 25 years as well as on the world literature, and the main emphasis is on the ecological aspects, notably the influence of climatic factors on the life-cycle and reproduction of the various species and their food-plant relations. An introductory section (pp. 3–35) contains an account of the development of *Citrus* cultivation in Palestine with a short survey of the fauna of *Citrus* groves and hedge plants ; a discussion of the feeding habits and distribution of the arthropods that attack *Citrus* and a key to the damage caused by various pests, mostly insects, in that country ; a brief summary of the relative importance of the principal arthropod pests of *Citrus* in other countries of the Mediterranean basin ; and a discussion of the factors affecting the general distribution of the Coccids associated with *Citrus* in them. The main part of the book (pp. 37–663) consists of ten chapters dealing in detail with the insects and mites that are injurious in Palestine ; the information given for each species varies, but includes descriptions for the field recognition of the pests and of their natural enemies and, in some cases, keys based on morphological characters, with information on synonymy, damage, world distribution, bionomics and control. The pests that occur in *Citrus* groves in Egypt, Cyprus, the Lebanon and Syria, Turkey, Transcaucasia, Iraq and Persia are surveyed in another chapter, and the control measures commonly used against *Citrus* pests are reviewed, largely from the literature, and with special reference to the underlying principles and present trends in their development, in a concluding one. The book has no index.

DE FLUITER (H. J.). **De invloed van daglengte en temperatuur op het optreden van de geslachtsdieren bij *Aphis fabae* Scop., de zwarte bonenluis.** [The Influence of Length of Day and Temperature on the Occurrence of the sexual Forms in *A. fabae*, the Black Bean Aphid.]—*Tijdschr. PlZiekt.* **56** pt. 4 pp. 265–285, 5 figs., 42 refs. Wageningen, 1950. (With a Summary in English.)

Advantage was taken in 1948 and 1949 of the establishment of stock cultures of *Aphis fabae* Scop. reared throughout the year on broad beans at Wageningen to test the effect of light and temperature on the production of sexual forms in Aphids. The literature on the subject is reviewed, and the annual cycle of development of *A. fabae* is summarised. In these stock cultures, which were kept under natural conditions of daylight, gynoparae and males were produced from about mid-September, at the same time as in the field, but apterae were also continuously produced in some lines. The winged forms produced from the last week of April were all virginoparae, and their appearance coincided with that of the winged migrants on *Euonymus* and other winter food-plants in the field [*cf.* *R.A.E.*, A **39** 127–128].

The summer experiments were carried out by exposing apterae on potted broad-bean plants to daylight for only eight hours per day, and the autumn and winter ones by supplementing the natural daylight by means of a fluorescent 40-watt daylight lamp placed a foot above the plants to give totals of 8–24 hours light per day. All tests were carried out in a room with a north aspect, and the temperature was varied in some of them. As soon as full-grown nymphs were observed, they were transferred to fresh broad-bean plants and kept under natural daylight conditions and room temperature. When they became adult, the alates were transferred, after their wings had been cut, to further broad-bean plants or *Euonymus*, and their progeny observed. The Aphids are said to enter the parthenogenetic stage when all the alates produced were virginoparae and the gametic stage when they were all either gynoparae or males. The experiments were carried out in the light of Uichanco's finding that the development of ova in parthenogenetic females of Aphids begins before the latter are born, so that the conditions to which a mature female is exposed may affect its progeny to the F_2 generation.

In the summer experiments, the offspring entered the gametic stage when exposure to the 8-hour day occurred at temperatures averaging 19°C. [66·2°F.] or less, the periods between transfer of the Aphids to these light conditions and the appearance of the first gynoparae being about a month, but when the exposure occurred at temperatures above 20°C. [68°F.], all the alates produced were virginoparae. In the winter experiments, the progeny entered the parthenogenetic stage when the exposure was to 13–24 hours' light at 12–19°C. [53·6–66·2°F.], the period to appearance of the first virginoparae being 11–14 days, but when the exposure was for 8–12 hours, the alates produced were gynoparae or males. These changes in development must have resulted from the conditions to which the original apterae were exposed and are thus consonant with Uichanco's finding. This was still further supported by a test in which gynoparae reared at 17°C. [62·6°F.] under conditions of 8 hours' daylight were transferred after their final moult to 22°C. [71·6°F.]. The offspring produced during the first ten days (about 80 per cent. of the total) were oviparae and the rest virginoparae, the change evidently being the result of the increased temperature acting on the embryonic stage.

[BURESH (I.), LAZAROV (A.), BALEVSKI (A.), BOGDANOV (V.) & ZHELEV (I.).] **Буреш (И.), Лазаров (А.), Балевски (А.), Богданов (В.) и Желев (И.). Die Frühjahrssaateule—*Agrotis temera* Hb. (Lep., Noct.) in Bulgarien im Jahre 1948.** [*A. temera* in Bulgaria in the Year 1948.] [*In Bulgarian.*]—*Trud. Inst. Zool. bulg. Akad. Nauk.* no. 1, 102 pp., 2 col. pls., 2 fldg. maps, 7 figs., 5 pp. refs. Sofia, 1950. (With Summaries in Russian and German.)

This booklet contains the results of investigations by the several authors carried out as a result of an outbreak of cutworms that caused very great losses of field crops in northern Bulgaria in the spring of 1948. The cutworm concerned was found to be *Euxoa* (*Agrotis*) *temera huebneri* Bours., and not, as was expected, *A. segetum* (Schiff.) or *A. tritici* (L.), both of which also occur in Bulgaria. Observations on its bionomics showed that it had one generation a year and overwintered in the egg. The adults emerged at the end of August, and were present throughout September. Eggs were laid chiefly on the surface of the soil. Their development was completed in 9–15 days, but they did not hatch until the first warm days in February or March. The larvae fed at first on weeds and on the young leaves of fodder plants, especially lucerne, but later attacked vegetable crops, especially broad beans, and also sugar-beet and grape vines, feeding at night. The larval stage lasted 52–76 days. The greatest damage was caused in the last instar, which lasted 16–26 days, in April-May. The fully-fed larvae entered the soil and constructed earthen cells in which they rested for 30–60 days before pupating, and the pupal stage lasted 26–30 days. All stages of var. *huebneri* are described, its distribution in Bulgaria in 1948 and the damage caused in various parts of the country are discussed, and the literature on the occurrence and biology of cutworms in Bulgaria is reviewed.

The organisation of control in 1948 is described. The best results were obtained from DDT sprays and dusts and dusts of benzene hexachloride, but poisoned baits of freshly cut weeds or lucerne were also effective. Other remedial measures practised were the collection of larvae and pupae, and trapping the adults by means of poisoned molasses or home-made light-traps.

BERAN (F.). **Die Wirkung von Dinitro-ortho-Kresol-Mineralölkombinationen im Frostspritzverfahren.** [The Effect of Combinations of Dinitro-o-cresol and Mineral Oil Sprays applied under Frost Conditions.]—*Pflanzenschutzberichte* **5** pt. 1–2 pp. 227–232, 5 refs. Vienna, 1950. (With a Summary in English.)

In further experiments in Austria with winter sprays applied under frost conditions [*cf. R.A.E.*, A **40** 44, etc.], fruit trees infested by *Quadraspidiotus* (*Aspidiotus*) *perniciosus* (Comst.) were sprayed during the winter of 1949–50 with two proprietary preparations containing dinitro-o-cresol at 5 and 4·2 per cent. and mineral oil at 81 and 69 per cent., respectively. The results were estimated in the following April–May and showed that 2 per cent. concentrations of either mixture applied at −2 to −4°C. [28·4 to 24·8°F.] gave 98·5–99·8 per cent. control as compared with no treatment and were as effective as 4 per cent. mixtures applied at 2–3°C. [35·6–37·4°F.]. Control was less satisfactory when the concentration was reduced below 2 per cent. No damage was caused to the buds of apple, pear or various stone fruits.

BÖHM (H.). **Beobachtungen über das Auftreten des rauhhaarigen Rosenkäfers als Schädling von Obstbaumblüten in Österreich** (*Tropinota* (*Epicometis*) *hirta* **Poda**). [Observations on the Occurrence of *Epicometis hirta* injuring Fruit Blossom in Austria.]—*Pflanzenschutzberichte* **5** pt. 3–4 pp. 241–257, 6 figs., 12 refs. Vienna, 1950. (With a Summary in English.)

Epicometis (*Tropinota*) *hirta* (Poda), the larva and adult of which are briefly described, caused serious damage to the blossoms of fruit trees in Austria in 1946–49, and investigations were carried out on its bionomics and control. The Cetoniid was reared in 1948–49 in outdoor cages and in the laboratory. The overwintered adults emerged from the soil in mid-April, became numerous in May–June and persisted in small numbers until August. They first attacked the flowers of wild plants, particularly dandelion (*Taraxacum officinale*), and then those of fruit trees, especially apple, feeding on the stamens and pistils and also on the receptacles of apple and pear. A list is given of 45 plants that were attacked. The beetles were active on warm, sunny days, but sheltered in the ground at night and in cold or cloudy weather. Pairing occurred 8–10 days after emergence, and eggs were laid soon after in light sandy soil or humus, dry hard soil being avoided. Oviposition occurred mainly at 19–23°C. [66·2–73·4°F.], and not below 15°C. [59°F.] or in dull weather. The egg, larval and pupal stages lasted 8–10 days, 7–8 weeks and 10–12 days, respectively [*cf. R.A.E.*, A **12** 435 ; **24** 677], and the adults hibernated in the pupal cells.

In laboratory experiments with dusts and sprays, E 605 (phosphoric acid esters) [*cf.* **40** 45, note] and BHC (benzene hexachloride) caused 100 per cent. mortality of adults in 24 and 48–72 hours, respectively, when applied to flowers on which they fed and in 6 and 24 hours when applied directly to the insects. DDT gave not more than 50 per cent. mortality in 96 hours in either test, and calcium arsenate in the first was ineffective. Larvae placed in dishes in moist sand mixed with dusts containing E 605 or BHC all died in 6 and 14 days, respectively, but DDT had no effect in three weeks.

In 1949, infested apple trees were sprayed with 0·05 per cent. E 605 forte (containing 45 per cent. active ingredients) or 1 per cent. of a material containing 14 per cent. BHC, and dusts of the same toxicants were diluted with soil and watered into a patch of ground heavily infested by larvae. The sprays had a good initial effect, but the residue was not toxic and did not prevent reinfestation. The soil treatments were effective, but as the larvae also occurred outside the orchards, they are not a practicable means of control. Various liquids placed as baits in jars in the trees gave inconclusive results, and when sticky papers of various colours were hung in or between the trees, numerous beetles were caught on white, yellow or orange ones, but injury to the blossoms was not appreciably diminished. Hand collection of the beetles during the middle of the day [*cf.* **24** 269] gave the best control.

WENZL (H.) & KAHL (E.). **Benetzungsfähigkeit und Oberflächenspannung.** [Wetting Property and Surface Tension.]—*Pflanzenschutzberichte* **5** pt. 3–4 pp. 258–267, 3 graphs, 9 refs. Vienna, 1950. (With a Summary in English.)

An account is given of laboratory experiments in Austria from which it is concluded that the surface tension of a liquid is a poor indicator of its wetting power [*cf. R.A.E.*, A **28** 570]. The latter can be ascertained by dipping or spraying techniques. The results obtained when cardboard covered with paraffin was used were not applicable to leaves, and dipping leaves did not give the same results as spraying [*cf.* **26** 280] when they had very smooth surfaces or strongly projecting veins on the underside. Cabbage leaves gave similar results by either method.

GUNN (D. L.). **Field Tests of dry Baiting against the Desert Locust,** *Schistocerca gregaria* **(Forsk.).**—*Bull. ent. Res.* **42** pt. 4 pp. 675–690, 6 figs., 27 refs. London, 1952.

JOYCE (R. J. V.). **Field Trials with various dry Baits against the Desert Locust,** *Schistocerca gregaria* **(Forsk.).**—*T.c.* pp. 691–696, 5 refs.

In view of the beginning of a new outbreak of *Schistocerca gregaria* (Forsk.) in 1949 [*cf. R.A.E.*, A **40** 24–25], and the difficulty of obtaining supplies of wheat bran and, in desert areas, of water for preparing the usual wet poison bait, investigations described in the first paper on the value of dry baits and of various substitutes for wheat bran were made in British Somaliland in March–April 1950 and in the Anglo-Egyptian Sudan in the following September–October. Baits in which the insecticide was mixed with the carrier in the form of oil solutions [*cf.* **31** 61] at the rate of 1 gal. per 100 lb. gave very successful results against bands of hoppers in preliminary tests, but since the oil solution was difficult to mix adequately with the bran and its use increased the cost, work on this method was not continued. Dry bran bait laid in lines in front of marching bands of hoppers in Somaliland was fully acceptable to them on ten occasions on which the bands were dense and the hoppers in the third, fourth and fifth instars, but very little was taken on two on which loose bands of second-instar hoppers, many of which were about to moult, were moving along a dry river bed ; there was little improvement in this case when the bait was moistened with water. The refusal of the locusts to take bait just prior to moulting [*cf.* **39** 190] was the only common cause of failure of dry bait, which otherwise gave successful results at all hours between 9 a.m. and 6 p.m. In the Sudan, where loose bands of hoppers marching through vegetation were the only ones available, dry bait was also taken extremely well, except on one occasion, when the temperature of the sand was at least 41°C. [105·8°F.] and the hoppers clustered on the vegetation ; in such circumstances, it is unlikely that wet bait would remain cool for long enough to be of any value [*cf.* **40** 138].

Limited experiments in Somaliland with ground barley husks, groundnut flour, dom flour (derived from nuts of *Hyphaene thebaica*), and coarse, medium and fine maize or sorghum flour as substitutes for wheat bran indicated that whereas dom flour was satisfactory, groundnut flour and barley husks did not give consistently reliable results. Ground maize and sorghum appeared satisfactory in the few tests made with them.

The best method of controlling marching bands of locusts is to place one or more lines of poison bait across their path, and roosting hoppers or bands of newly hatched hoppers can frequently be controlled by laying a ring of bait round them ; by using dry bait, locust scouts on camels or vehicles can destroy small bands as soon as they find them. Dry baits are best applied by means of a funnel, referred to as the Shendi funnel, which is designed to be tied to the back of a vehicle. It is some 25 ins. high and 14 ins. across, and has a vertical piece of wire fixed loosely to the top of the narrow exit, so that the bait can be loosened if it cakes. The bait can also be rapidly distributed over an area in which locusts are loosely scattered by means of power dusting equipment with a vertical extension pipe, such as is used for dusting trees, from which the bait is dispersed by the wind. A dosage of 25 lb. bait per acre with swathe widths of 35 yds. is recommended, and it should be possible to carry out the treatment at the rate of 0·5 acre per minute. In Somaliland, a dry bait containing BHC (benzene hexachloride) distributed at about 11 lb. per acre gave 50–75 per cent. control in 24 hours over an area infested by about five hoppers per square yard, and in three experiments in the Sudan in which bait was applied over areas covered almost entirely with vegetation, mortality from bait containing 2·5 per cent. sodium arsenite distributed at 30 and 46 lb. per acre and from one containing 0·5 per cent. BHC at 55 lb. per acre was virtually complete. Young adults were killed by dry bait when they were present in hopper bands, but deliberate attempts to destroy them were only partially successful, probably owing to the difficulty of ensuring that they came in contact with the bait. Dry bait containing BHC applied by machine in a crop of sorghum in the Sudan remained effective for only three days ; one containing sodium arsenite caused no mortality until the fourth day after application, but remained effective for at least another ten days, after which heavy rain fell.

In the second paper, in which further experiments in the Sudan to discover a substitute for wheat bran are described, it is stated that dry bran containing 2·5 per cent. sodium arsenite or 0·5 per cent. BHC was used successfully against *S. gregaria* during the winter of 1950–51 on the Red Sea coast, except at one place where strong winds blew it away. The first application was against a large invading swarm of adults during November and was so successful that few eggs were laid ; most of the resulting hoppers were destroyed by means of dry bait before they reached the third instar. In the experiments, the materials tested comprised surplus stocks of maize meal and maize bran containing 2·5 per cent. sodium arsenite from South Africa and crushed sorghum or maize. The results of tests of the acceptability of crushed sorghum of different degrees of coarseness to bands of marching hoppers indicated that there were only small differences between any of them and wheat bran, but sorghum passing through a 20-mesh sieve and stopped by a 30-mesh appeared to be somewhat superior and that stopped by a 20-mesh sieve somewhat inferior. Maize bran containing 2·5 per cent. sodium arsenite was less acceptable than the other materials, but the mortalities given by it and by coarse sorghum mixed with 0·5 per cent. BHC appeared to be no lower than those from the most acceptable BHC baits.

BARNES (H. F.). **The Gall Midges of St. John's Wort (*Hypericum* spp.), with Descriptions of two new Species.**—*Bull. ent. Res.* **42** pt. 4 pp. 697–705, 4 figs., 3 refs. London, 1952.

In view of the importance of *Hypericum perforatum* as a noxious weed and attempts to control it by introduced insects in Australia [*cf. R.A.E.*, A **39** 38, etc.] and California [**39** 316, etc.], notes are given on the Cecidomyiids, two of which are described as new, that are associated with *Hypericum* spp. The information given includes the characters by which the species are distinguished, their distribution, food-plants, and sometimes habits, and brief descriptions of the galls formed. The species associated with *H. perforatum* are *Dasyneura hyperici* (Bremi), *D. serotina* (Winn.), *Macrolabis marteli* Kieff. and *Zeuxidiplosis giardii* (Kieff.), all of which attack the leaves in several European countries, *Contarinia hyperici*, sp. n., *Clinodiplosis hyperici*, sp. n., and *Leptodiplosis* sp., which have been reared from unopened flowers in England, and *Geocrypta braueri* (Handl.), which forms galls on the underground shoots of *H. perforatum* and *H. pulchrum* in several parts of Europe. Cecidomyiids recorded from other species of *Hypericum* include *D. toweri* Felt and *Lasioptera virginica* Felt, from the flowers of *H. mutilum* and the stems of *H. virginicum*, respectively, in Massachusetts, *G. hypericina* Tavares, which forms galls on the underground shoots of *H. pulchrum* in Spain, and an unidentified gall-midge, the larvae of which have been recorded from flowers of *H. pulchrum* in England. *Trisopsis hyperici* Tavares and *Lestodiplosis hyperici* (Tavares) have been reared from the galls of *G. hypericina*.

LLOYD (D. C.). **Biological Observations on some Thynnids of western Patagonia.**—*Bull. ent. Res.* **42** pt. 4 pp. 707–719, 2 pls., 3 figs., 6 refs. London, 1952.

The following is based largely on the author's summary. During a survey of parasites of Melolonthids carried out in southern Argentina for the Government of New Zealand in 1945–47, six Thynnids were found in western Patagonia and studied in varying degrees of detail. Of the three for which definite host records were established, *Elaphroptera scoliaeformis* (Hal.) attacks larvae of the Rutelid, *Aulacopalpus pilicollis* (Fairm.), which are the common white grubs in natural pasture and cultivated land in the region, *Elaphroptera* sp. near *nigripennis* (Smith) attacks those of the Melolonthid, *Macrosoma glacialis* (F.) in *Libocedrus* forest, and *Pseudelaphroptera brevipilosa* Duran larvae of the weevil, *Adioristus acuminatus* Hust., which occur in the soil of pastures ; all three are solitary external parasites of the mature larvae. Adults of *E. scoliaeformis* and *Elaphroptera* sp. near *nigripennis* were not observed to feed during the mating flight [*cf. R.A.E.*, A **22** 110], but pairs of *P. brevipilosa* fed extensively at umbelliferous flower heads. Some evidence was obtained that the males tend to return the wingless females after the flight to the sites from which they took them up, which does not support the view held by some that this flight serves to disseminate the species ; furthermore, the principal foci for *Elaphroptera* remained at about the same sites for several seasons. The hosts are paralysed and malaxated before eggs are laid on them. The parasite larvae pass through five instars and do not move over the host ; they suck the juices of the host until they reach the last instar, when they consume the body tissues. The cocoons made by the female parasite are shorter and more rigid than those of the males. All three species have one generation a year. The period from oviposition to cocoon formation is generally about three weeks, and at least nine months are spent in the cocoon as a mature larva or prepupa. Adults probably survive for up to two months. The cocoon stages of *Elaphroptera* sp. near *nigripennis* were attacked by a Bombyliid parasite of the genus *Acrophthalmyda* and a Carabid predator of the genus *Cnemacanthus*, and the males by the Asilid, *Lycomya germainii* Big.

Parasitism by the three Thynnids averaged only about 23 per cent., and it is thought that none of those present is of great value in control.

Priesner (H.). **Studies on the Genus *Scolothrips* (Thysanoptera).**—*Bull. Soc. Fouad Ier Ent.* **34** pp. 39–68, 7 figs., 65 refs. Cairo, 1950.

From a comparative study of thrips of the genus *Scolothrips*, which feed on Tetranychids, from various parts of the world, the author gives an amended description of the genus, descriptions of 15 species, of which six are new, with indications of their distribution and the plants and in some cases the mites with which they were found associated, and keys to the adult females of 13 and the males of six. He concludes that there has been considerable confusion regarding the identity of *S. sexmaculatus* (Perg.), which has been recorded from various countries but is probably confined to the United States. Records of it there by Bailey [*R.A.E.*, A **27** 410] and Hood [**6** 34] refer to *S. pallidus* (Beach) and a species here described as *S. hoodi*, sp. n., respectively. *S. longicornis* Priesn. is widely distributed in Europe and also occurs in Egypt and California. Various doubtful or incorrect records of *S. sexmaculatus* [**2** 267 ; **16** 669 ; **21** 322, 501] and *S. longicornis* [**27** 43] are pointed out in a review of the literature with reference to the feeding habits of the thrips and in an annotated bibliography.

Talhouk (A. S.). **A List of Insects observed on economically important Plants and Plant Products in Lebanon.**—*Bull. Soc. Fouad Ier Ent.* **34** pp. 133–141, 1 ref. Cairo, 1950.

A preliminary list is given of insects and mites that attack plants of economic importance in the Lebanon, based on observations, mostly in orchard areas, over a period of 16 years. They are arranged under their food-plants, and the economic importance of each is indicated. A short list of insects that attack stored food products is appended.

Ghabn (Abd El-Aziz Ali El-Sayed). **Field Tests on a Number of old and new Insecticides against *Thrips tabaci* Lind. (Thysanoptera) attacking Cotton Seedlings and Onion in Egypt.**—*Bull. Soc. Fouad Ier Ent.* **34** pp. 173–242. Cairo, 1950.

A detailed account is given of tests in Egypt in which DDT and BHC (benzene hexachloride) were compared with older insecticides in 1946–47 and with HETP (hexaethyl tetraphosphate) and parathion in 1948–49 for the control of *Thrips tabaci* Lind. on cotton seedlings or onion. In all, 35 separate formulations, mostly proprietary products, were tested, and they were applied once or twice at an interval of ten days. In the tests in 1946 and 1947, various formulations of DDT and BHC in sprays proved more effective and persistent than a spray of paris green, nicotine sulphate, slaked lime and molasses, another including o-dichlorobenzene and soft soap, another of wood tar and sodium hydroxide, or an oil emulsion on both cotton seedlings and onions grown for seed, and than lime-sulphur and a mixture of nicotine sulphate and soft soap, which were used only on onion.

In 1948, further experiments were made on cotton with sprays containing DDT as wettable powders or emulsion concentrates, BHC in miscible oil, wettable BHC, HETP and parathion and dusts of BHC, DDT and parathion. Infestation was light, damage on the untreated plots did not exceed 5 per cent., and mortality was in consequence sometimes low. The parathion treatments gave outstanding control when applied either once or twice. The dust, which contained 2 per cent. parathion, and sprays of 0·02 and 0·04 per cent. E 605 f (containing 75 per cent. parathion) and 0·05 per cent. wettable DDT were the best materials in the tests in which only one application was made and gave averages of 98·9, 95·9, 90·6 and 48·5 per cent. mortality, respectively, and in the series with two applications, from which the parathion dust was omitted, the most effective materials were the two parathion sprays, which gave 98·9 and 98·3 per cent. mortality, respectively, and 0·0026 per cent. γ BHC in 1 per cent. mineral oil, which gave 66·2 per cent. HETP was not particularly effective.

In the later tests with onions grown for seed, greater importance was attached to the increased yields resulting from the use of insecticides than to the mortalities caused by them. In 1948, when preparations of DDT as a liquid concentrate or a wettable powder, wettable BHC and dusts of BHC and DDT were compared, the greatest increase in yield (69 per cent.) following a single application was obtained from plants sprayed with 0·025 per cent. wettable DDT, though this gave the lowest thrips mortality (74·6 per cent.). In tests in which each material was applied twice, a dust containing 0·65 per cent. γ BHC gave the greatest increase in yield (93 per cent.) and very high mortality. In 1949, when the same formulations, with the addition of the dust and sprays of parathion, were compared, the parathion dust was the most effective, one and two single applications resulting in increases in yield of 82 and 99 per cent., respectively ; the three next most effective materials were sprays of 0·02 per cent. E 605 f and the liquid concentrate diluted to give 0·05 per cent. DDT and the BHC dust, the percentage increases in yield, being 67, 59 and 56, respectively, for one application and 76, 69 and 64 for two.

Experiments with onions grown for consumption were also carried out in 1948 and 1949 ; various sprays and dusts of DDT and BHC were tested in both years, and the dust and sprays of parathion in 1949. In the tests of single applications, the greatest increase in yield and highest mortality were given by wettable BHC at a concentration giving 0·026 per cent. γ BHC (112 per cent. increase) and the BHC dust (97 per cent. mortality), respectively, in 1948 and by 0·05 per cent. wettable DDT (36 per cent. increase) and the liquid concentrate diluted to give 0·05 per cent. DDT (100 per cent. mortality), respectively, in 1949. In the tests of two applications, the greatest increase in yield and highest mortality were both given by the BHC dust (116 and 99·3 per cent., respectively) in 1948 and by the liquid concentrate diluted to give 0·025 per cent. DDT (68 per cent.) and 0·025 per cent. wettable DDT (96 per cent.), respectively, in 1949 ; in these tests, the insecticides appeared to be more effective when used at low concentrations that at high ones, which injured the plants. The cost of the various treatments is discussed.

HUSSEIN (M.). **A Comparison of wet and dry Bran Baits.**—*Bull. Soc. Fouad Ier Ent.* **34** pp. 243–246. Cairo, 1950.

Since wet bait for the control of locusts and grasshoppers is difficult to prepare under desert conditions, experiments were begun in Egypt in 1943 on the value of dry bait. Preliminary experiments were made in cages covering sandy areas in which plants were growing. In August 1943, when a bait consisting of 4 per cent. barium fluosilicate in wet or dry bran was applied broadcast to two patches of maize infested by adults of *Eyprepocnemis* (*Euprepocnemis*) *plorans* (Charp.), both gave considerable mortality, with no significant difference between them. During April–July 1950, when large numbers of adults and hoppers of *Schistocerca* [*gregaria* (Forsk.)] were offered growing plants, wet bran and dry bran, hoppers in the first two instars tended to aggregate on the green food and the older hoppers and adults on the bran. When temperatures in the shade and at the soil surface were 24–28 and 28–35°C. [75·2–82·4 and 82·4–95°F.], respectively, and the relative humidity 65–72 per cent., most of the adults and older hoppers fed on the dry bran, but when the range of air and soil temperatures increased to 28–33 and 36–40°C. [82·4–91·4 and 96·8–104°F.] and the relative humidity was 62–71 per cent., more congregated on the wet bran. When the air and soil temperatures increased still further to 31–37 and 39–46°C. [87·8–98·6 and 102·2–114·8°F.], the relative humidity was 65–71 per cent., and the bran was placed in the shade, the locusts did not discriminate between wet and dry bran. It is concluded that they were attracted by the wet bran when the soil was hot because it was cool to rest on, and that more of it was then eaten. It is pointed out that wet bran spread thinly would quickly lose its moisture at high temperatures and low humidity. The addition of colouring matter to the bran had little effect on the results.

As adults and the older hoppers of *E. plorans* were often observed in the field feeding on dry vegetation, hay (under which they sheltered) and maize seeds, a comparative test of wet and dry bait was made in July 1950 in maize fields in which the plants were 8–12 ins. high ; the insects, 60–70 per cent. of which were adult, were mostly congregated in dense weeds round the edges. Wet or dry bran mixed with 3 per cent. benzene hexachloride was broadcast thinly over six plots and one was left untreated. Six hours later, insects were collected from each plot and put in cages with green food. After 48 hours, mortality averaged 15 per cent. among those from plots baited with dry bran, 22 per cent. among those from plots baited with wet bran and 0 in the control, but after 96 hours, these percentages increased to 71, 72 and 5. Further investigations are considered necessary before dry bait can be generally recommended.

El-Sawaf (S. K.). **The Life-history of the Greater Wax-moth (*Galleria mellonella* L.) in Egypt, with special Reference to the Morphology of the mature Larva (Lepidoptera : Pyralidae).**—*Bull. Soc. Fouad Ier Ent.* **34** pp. 247–297, 37 figs., 39 refs. Cairo, 1950.

Observations were made in 1947–48 on the bionomics of *Galleria mellonella* (L.) in Egypt, where this Pyralid causes considerable losses among the wax-combs of honey bees, especially those in storage, and also among the bees themselves. It appears to be particularly destructive in mud hives, which are those most commonly used. All stages are described, and detailed accounts are given of the morphology and internal anatomy of the full-grown larva and the rearing techniques adopted. There were four overlapping generations a year. Adults of the overwintering generation emerged from late February to early June, and those of the first, second and third generations from early July to early August, late August to early October, and early September to early December, respectively. The eggs were laid in masses in cracks and crevices in the hive and fertilised females deposited 500–1,813 each. The egg-stage lasted 9–10 days in summer and autumn and 17 in spring. Larvae of the first generation hatched in the middle of May, and they and those of the next two generations completed their development in 37–70 days, whereas those of the overwintering generation required 98–225 days ; the latter hatched in the middle of October and most of them pupated in March–April. The cocoons were usually spun on the comb or in débris in the hive. The pupal stage lasted 8–11 days in the first two generations and 9–23 and 12–49 days in the third and the overwintering generation, respectively. It was one day shorter for males than for females, and the males were the first to emerge. Males survived in the laboratory without food for 21–30 days and females for 8–15 days. The two sexes were about equally numerous. Single larvae consumed 1·36–1·57 gm. wax during their development, and the progeny from single females totals of 442–665 gm.

RICHARDS (O. W.). **Parasitic Hymenoptera found in British Houses, Warehouses and Ships. I : Ichneumonidae.**—*Proc. R. ent. Soc. Lond.* (B) **18** pt. 1–2 pp. 19–35, 7 figs., 28 refs. London, 1949.

This paper, which is the first of a proposed series on Hymenopterous parasites found associated with stored products in Britain during the late war, deals with the Ichneumonids. It includes a key to the eight species recorded, followed by descriptions of the genera and species and notes on the circumstances in which they were taken, the insects with which they were associated, and their possible hosts.

HOLMES (E.). **Recent British Developments in Taint-free Use of BHC.**—*Agric. Chem.* **6** no. 12 pp. 31–33, 113, 115, 4 refs. Baltimore, Md., 1951.

The author reports that in Britain, the use of BHC (benzene hexachloride) on agricultural crops without tainting has been attained by developing formulations containing substantially pure γ BHC, by using these according to new techniques and by using crude BHC (13 per cent. γ isomer) for certain purposes according to a carefully timed schedule. He points out that BHC is absorbed through the roots or foliage of potatoes, onions, black currants and possibly carrots and translocated within the plants, whereas cereals, apples, plums, tomatos, strawberries and mushrooms do not seem to absorb it, though taint will occur if BHC is still present on them at harvest.

One of the more important uses of BHC in Britain is for the control of wireworms (*Agriotes* spp.) attacking cereals and sugar-beet, particularly in soils newly broken from pasture ; there is no record of taint in cereals, and though fresh sugar-beet may occasionally have been tainted, the taint could not persist into the manufactured sugar. Potatoes grown in soil treated with BHC dusts, either broadcast or applied with a combine drill, are liable to taint for some years, and they should not be grown for two years or more on land on which crude BHC has been broadcast at 6 lb. per acre. Uneven application of small quantities may result in patches of tainted crops, and surface treatment is less dangerous than working the same amount of BHC into the soil. Crude BHC applied against *Psila rosae* (F.) has tainted carrots, and onions are fairly readily affected, but no taint has been reported in mushrooms or tomatos. Tree fruits are not tainted by crude BHC, but black currants are very susceptible. The γ isomer has given much more satisfactory results, but even this taints potatoes and black currants, though seldom at insecticidal rates of application. At 0·5 lb. per acre, which is the minimum for effective control of ordinary populations of wireworms in potato soils, 90 per cent. γ BHC may cause taint if applied just before planting and the application should therefore be made the autumn before or spread over two seasons ; γ BHC approaching 99·9 per cent. purity sometimes also causes taint.

Observations in 1948–51 showed that broadcast treatment with crude BHC giving 12 oz. γ BHC per acre, combine drilling giving 4–6 oz. γ BHC per acre and seed dressing with 1 oz. γ BHC per acre [*cf. R.A.E.*, A **39** 201] gave 90–100, 80–100 and 70–100 per cent. protection of cereals from heavy attacks by *Agriotes*, and the first cost about six times as much as the last. Inadequate protection by seed treatment, which occurred on 0·42 per cent. of the area sown, was found to be due to damage by *Tipula* spp., failure to obtain a satisfactory seedbed, seeding rates appreciably below normal or excessive wireworm populations (a million or more per acre). Results were less satisfactory for autumn than for spring sowings, on heavy soils than on medium or light ones and on land that had been under permanent grass than on land of any other class. Emergency surface applications of BHC to cereals already showing wireworm damage did not give economic results.

Crude BHC in a 50 per cent. dispersible powder has given control of a wider range of pests on apple than any other treatment. It is used at 4 lb. per 100 gals. at bud-burst against *Anthonomus pomorum* (L.), at the green-cluster stage against *Anuraphis roseus* Baker, *Aphis pomi* Deg., *Psylla mali* (Schm.) and Lepidopterous larvae, and at the pink-bud stage against *Plesiocoris rugicollis* (Fall.) and *Eriosoma lanigerum* (Hsm.) and at 2–3 lb. per 100 gals. at petal-fall against *Hoplocampa testudinea* (Klug). The schedule is modified according to which insects are numerous. BHC is useless against *Paratetranychus pilosus* (C. & F.) (*Oligonychus ulmi* (Koch)), which is controlled by phosphorus compounds, particularly parathion, later in the season, and has little effect on *Cydia pomonella* (L.), which is of little importance in Britain. In one test in 1950, an application of 2 lb. 50 per cent. wettable BHC per 100 gals. at petal-fall (following one of 4 lb. at the green-cluster stage) reduced the percentage of apples damaged by *H. testudinea* from 10·6 for no treatment to 0·15, as compared with 0·6 for 0·005 per cent. parathion and 2·3 for lime-sulphur applied twice.

Hill (A. R.). **The Bionomics of *Lampronia rubiella* (Bjerkander), the Raspberry Moth, in Scotland.**—*J. hort. Sci.* **27** no. 1 pp. 1–13, 1 pl., 2 graphs, 17 refs. London, 1952.

The following is based largely on the author's synopsis. *Incurvaria* (*Lampronia*) *rubiella* (Bjerk.), which causes serious damage to cultivated raspberries, is a major pest in the fruit-growing areas of eastern Scotland, but less abundant in southern England, though there have been indications that it may become more widespread and abundant there [*cf. R.A.E.*, A **38** 472]. All stages are described.

Observations on its bionomics showed that the eggs are deposited in the fleshy tissue at the base of the corolla and androecium during June and July. The larvae feed on the surface tissue of the developing fruitlets for a short time, but penetrate into them and feed on the fleshy receptacles within a few days. In August, after reaching the second instar, they leave the fruits, or the receptacle if the fruit has been picked, moult, and hibernate, usually in the soil close to the roots of the raspberry plants. In spring, when the raspberry buds are bursting, the larva leaves its hibernaculum and crawls up a cane until it finds a suitable bud, into which it tunnels through the closely packed leaflets. Some larvae attack only one bud and then pupate in it, but others leave the first bud and attack young laterals 2–3 ins. long, pupating on leaves, stems or supporting posts or wires. The pupal stage lasts three weeks. Adults appear in June and are abundant during the second half of the month [*cf.* **32** 159].

The main damage occurs after the larvae have hibernated. Primary buds that are destroyed are usually replaced by secondary ones, but if these are damaged by migrating larvae, the chances of recovery are materially reduced. In the course of the study, an example of the Ichneumonid, *Angitia* (*Horogenes*) *exareolata* (Ratz.), was bred from a larva.

Blair (C. A.) & Groves (J. R.). **Biology of the Fruit Tree Red Spider Mite *Metatetranychus ulmi* (Koch) in south-east England.**—*J. hort. Sci.* **27** no. 1 pp. 14–43, 1 pl., 11 figs., 42 refs. London, 1952.

Paratetranychus pilosus (C. & F.) (*Metatetranychus ulmi*, auct.), which occurs in all the fruit-growing areas of the world except South Africa, is most injurious in Britain in the south-eastern counties, where it is a serious pest of apple. The nomenclature of the mite is discussed, all stages and the injury caused by it are described, and an account is given of investigations in 1945–49 on its bionomics, the results of which are compared with those obtained in other countries [*R.A.E.*, A **17** 390; **30** 576; **33** 124; **39** 421]. The size of the mite population is affected by the number of generations a year (which was found to be five in Essex and Kent); the activities of predators, of which *Anthocoris nemorum* (L.), *Orius majusculus* (Reut.), *Stethorus punctillum* Weise, *Blepharidopterus angulatus* (Fall.) and *Conwentzia pineticola* End. [*cf.* **40** 69] were the most important; the weather, particularly temperature, which influences the duration of development; the use of tar-distillate sprays in winter and DDT sprays in summer, which destroy predators; and migration (mainly of adult females) when food supplies are exhausted.

The observations showed that the winter eggs hatch between April and June, the date depending on the previous spraying programme, the situation of the orchard and the weather in April and early May. The first summer eggs were laid in May, and two generations of mites, but not more, were sometimes present on the leaves at once. Winter eggs were laid by the third and fourth generations, and by the second when the leaves were badly bronzed by heavy infestations, beginning in late July or early August; mites of the second and third generations laid both summer and winter eggs, and it was shown that individual females could lay eggs of both types. The differences between these are described. After the larval stage, the females pass through two and the males one or two nymphal stages. In the laboratory, the incubation period of the summer eggs, the larval and nymphal stages and the preoviposition period averaged 11, 4, 8 and 3 days. The females laid an average of 11·2 and a maximum of 46 eggs each in about 11 days, and the average and maximum durations of life were 10·5 and 22 days for males and 12 and 34 for females. Females were more numerous than males. Unfertilised females produced only male offspring, and fertilised ones both males and females.

Although apple is the chief food-plant of the mite in England, heavy infestations have also been observed on plum, greengage, damson and pear, and many cultivated and hedgerow plants and weeds are attacked. No wholly resistant variety of apple or plum was found, but Bramley's Seedling apple and Victoria plum were less seriously damaged than other varieties.

MARKHAM (R.) & SMITH (K. M.). **Studies on the Virus of Turnip Yellow Mosaic.**—*Parasitology* **39** no. 3–4 pp. 330–342, 4 pls., 4 figs., 20 refs. London, 1949.

Some of the information in this account of work on the properties and transmission of the virus of turnip yellow mosaic has already been noticed from earlier reports [*R.A.E.*, A **36** 377]. It occurs naturally in turnip, swede and broccoli, has been transmitted experimentally to radish, cabbage, several other species of *Brassica*, watercress (*Nasturtium* spp.) and shepherd's purse (*Capsella bursa-pastoris*), but not to plants of other families, and is known from south-western England, eastern Scotland and Portugal. The symptoms it causes are described. It is transmitted in the field by *Phyllotreta* spp. [*loc. cit.*], and the species that transmitted it under experimental conditions included *P. undulata* Kutsch., *P. cruciferae* (Goeze), *P. nemorum* (L.) and *P. atra* (F.); transmission was also effected by larvae and adults of *Phaedon cochleariae* (F.) and adults of the Tettigoniid, *Leptophyes punctatissimus* (Bosc), the Acridid, *Chorthippus brunneus* (Thnb.) (*Stauroderus bicolor* (Charp.)), and *Forficula auricularia* L., but not by Lepidopterous larvae, Aphids or Mirids. Adults of *Phyllotreta* retained the virus for 72 hours and infected three plants in succession at intervals of 24 hours; they remained infective when starved for 48 hours after feeding on diseased plants. Starved adults acquired the virus after feeding on infected plants for 24 hours and retained it for three days. *L. punctatissimus* and *C. brunneus* transmitted it after feeding on diseased plants for 48 hours, and *F. auricularia* after only 24 hours; the first two remained infective for one and three days, respectively. Larvae of *Phaedon cochleariae* retained the virus for four days, and some evidence was obtained that the number of plants that they can subsequently infect is determined by the duration of the feeding period on the diseased plant. They acquired the virus after feeding on an infected plant for only one minute, but usually seemed unable to transmit it until 24 hours later. Newly emerged adults that developed from larvae reared on diseased plants were not infective. When drops of a concentrated solution of the virus with the addition of sucrose were placed on the mouthparts of adult *Phyllotreta*, the latter did not transmit the virus, but beetles that were allowed to feed on the solution after being starved for 24–48 hours did so, and infection did not appear to be due to mechanical transfer.

In a discussion of the relation between the virus and its insect vectors, the work is stated to be the first recorded instance of the transmission of a crystallisable plant virus by insects. The experiments with *Phaedon* larvae, which do not immediately become infective, indicate that the virus is not carried mechanically on the jaws of the vector. Insects with sucking mouthparts that transmit persistent viruses appear to do so through their saliva, but salivary glands are absent or rudimentary in all the biting insects, with the possible exception of *Leptophyes*, that have been shown to transmit turnip yellow mosaic, though they are present in the Lepidopterous larvae that did not transmit it. Beetles are thought to regurgitate part of the contents of the foregut during feeding in order to facilitate the digestion of leaf tissue, and infection may take place during this process. Examination of the alimentary canal of *Phyllotreta* and larvae of *Phaedon cochleariae* showed that the valve that in Aphids prevents regurgitation is in them situated at the lower end of the foregut, in such a position that regurgitation is possible. In larvae of *P. cochleariae*, ingested leaf material appeared to lie very close to the mouth.

Methods by which the virus was obtained in purified and crystalline form and the results of studies on its biochemical nature are described.

WATSON (M. A.), HULL (R.), BLENCOWE (J. W.) & HAMLYN (B. M. G.). **The Spread of Beet Yellows and Beet Mosaic Viruses in the Sugar-beet Root Crop. I. Field Observations on the Virus Diseases of Sugar Beet and their Vectors** *Myzus persicae* **Sulz. and** *Aphis fabae* **Koch.**—*Ann. appl. Biol.* **38** no. 4 pp. 743–764, 3 figs., 16 refs. London, 1951.

The following is virtually the authors' summary. A survey of Aphids and virus diseases of sugar-beet root crops in eastern England was made between 1940 and 1948. Prior to 1943, the observations were made on plots used for fertiliser experiments ; from 1943 onwards, they were made on commercial fields selected for position in relation to beet and mangel seed crops. The incidence of beet yellows increased with increasing numbers of *Myzus persicae* (Sulz.), but not of *Aphis fabae* Scop. The relation with *M. persicae* was sufficiently close to suggest that it is the most important, possibly the only important, vector of yellows virus [*cf. R.A.E.*, A **35** 205]. Beet mosaic also increased with increasing numbers of *M. persicae*, but the relation was not close enough to exclude the possibility of other vectors.

Numbers of *A. fabae* on sugar beet were slightly, but consistently, depressed by the use of salt as a fertiliser. Other fertilisers had variable effects. Neither virus nor Aphids are likely to be greatly affected by fertilisers.

Beet yellows is most prevalent in areas where seed crops are grown, but within these areas nearness to individual seed crops did not appear to increase its incidence. *M. persicae* was more numerous on sugar beet in seed-crop areas than elsewhere, and this alone might account for the prevalence of yellows. Beet mosaic virus is more closely associated with seed crops than is beet yellows. It is most prevalent near to seed crops within the seed-crop areas.

BAWDEN (F. C.), CHAUDHURI (R. P.) & KASSANIS (B.). **Some Properties of Broad-bean Mottle Virus.**—*Ann. appl. Biol.* **38** no. 4 pp. 774–784, 1 pl., 11 refs. London, 1951.

The following is taken largely from the authors' summary. A severe disease affecting many plants in a crop of broad beans in Nottinghamshire in July 1947 was found to be caused by a previously undescribed virus, provisionally named broad-bean mottle virus. The distribution of diseased plants suggested spread by a vector, but none of five species of Aphids or *Sitona lineatus* (L.) transmitted it. The virus was transmitted to several species of leguminous plants by mechanical inoculation of sap ; infectivity for some hosts seemed to be increased by propagation in these hosts. The properties of the virus are described.

CADMAN (C. H.). **Studies in *Rubus* Virus Diseases. I. A latent Virus of Norfolk Giant Raspberry.**—*Ann. appl. Biol.* **38** no. 4 pp. 801–811, 1 pl., 11 refs. London, 1951.

The clone L234 of the Norfolk Giant variety of raspberry was thought to be free from virus disease and from 1944 was used as an indicator in investigations in Scotland [*cf. R.A.E.*, A **38** 470]. In 1948, however, healthy plants of *Rubus saxatilis* to which Aphids (*Amphorophora rubi* (Kalt.)) from plants of this clone were transferred developed conspicuous mosaic symptoms, and some plants of *R. henryi* that were grafted with scions from it developed necrosis ; furthermore, raspberries of one commercial variety that were grafted to L234 in eastern England became severely dwarfed in 1947. These observations were confirmed by experiments in Scotland in 1947–50 in which grafting with scions from clone L234 caused necrosis in healthy plants of *R. henryi* and the appearance of mosaic symptoms in *R. saxatilis*, a variety of the American black raspberry (*R. occidentalis*), and some commercial varieties of red raspberry ; no symptoms developed in plants of the indicator variety Baumforth's Seedling B, but evidence was obtained that it may be a symptomless carrier. It is concluded that clone L234 is a symptomless carrier of a virus, believed to be distinct, for which the name raspberry leaf mottle is proposed ; probably all the plants of the clone are infected. The virus was also found to occur in commercial stocks of some other varieties.

In transmission experiments, symptoms developed on plants of *R. saxatilis* and *R. occidentalis* to which batches of *A. rubi* were transferred from clone L234. The disease developed after infection feeding periods of not less than ½ hour on L234, and the virus persisted for at least 18½ hours in the Aphid, though it is stated in a footnote to have rarely persisted for longer than four hours in more recent experiments. No transmission was effected in similar tests with *Aphis* (*Doralis*) *idaei* v.d. Goot.

CROXALL (H. E.), COLLINGWOOD (C. A.) & JENKINS (J. E. E.). **Observations on Brown Rot (*Sclerotinia fructigena*) of Apples in Relation to Injury caused by Earwigs (*Forficula auricularia*).**—*Ann. appl. Biol.* **38** no. 4 pp. 833–843, 1 pl., 6 figs., 7 refs. London, 1951.

The following is largely the authors' summary. Observations in orchards in the West Midlands in 1947–50 on apples of the varieties Cox's Orange Pippin and Laxton's Superb showed that brown rot (*Sclerotinia fructigena*) was often associated with shallow holes in the fruits. Laboratory experiments with undamaged apples indicated that *Forficula auricularia* L. could cause injury of this type. Bands of sacking soaked in an emulsified solution containing 3 per cent. benzene hexachloride, placed round trunks of Laxton's Superb and renewed at intervals of three weeks, trapped many earwigs in 1949 and 1950, and less brown rot occurred on these trees than on the controls; sacking steeped in a paste made by diluting a wettable powder containing 25 per cent. DDT in water to give 5 per cent. actual DDT was of little value. A survey of picked fruits in 1950 showed close correlation between degree of earwig damage and amount of brown rot. Earwig damage was appreciable in fruits from ten out of 13 grass orchards, but was negligible in fruits from nine arable plantations.

WHITE (J. H.). **Observations on the Life History and Biology of** ***Tipula lateralis*** **Meig.**—*Ann. appl. Biol.* **38** no. 4 pp. 847–858, 7 figs., 8 refs. London, 1951.

Large numbers of larvae of *Tipula lateralis* Mg. appeared for the first time in watercress beds in eastern England in March 1948. They were reported to be damaging the cress by biting through the stems, but observations on commercial beds and laboratory experiments showed this Tipulid to be primarily saprophytic, feeding on rotting cress leaves, though the larvae in the last instar can develop on green cress. Populations as high as 250,000 per acre did not affect the cress adversely.

The paper includes descriptions of the immature stages and an account of observations on the bionomics of *T. lateralis*. There were two generations a year and probably a partial third, and development was completed in 63 days. The females laid an average of 511 eggs each, and the preferred site for oviposition was on wet soil. The larvae pupated in various sites, such as in the earthen sides of beds above water level, in cracks in concrete sides of beds and under moss or lichens, but only very seldom, if ever, under water.

McINTOSH (A. H.). **Particle Size of insecticidal Suspensions and their contact Toxicity. IV. Mechanisms of Action of different-sized Particles.**—*Ann. appl. Biol.* **38** no. 4 pp. 881–898, 3 pp. refs. London, 1951.

The following is virtually the author's summary of this part of a series. Two earlier papers [*R.A.E.*, A **37** 263; **38** 232] showed that in tests of suspensions by dipping, large crystals of DDT could kill grain beetles (*Tribolium castaneum* (Hbst.) and *Oryzaephilus surinamensis* (L.)) just as efficiently as colloidal DDT, but with rotenone, colloidal particles were far more toxic than large crystals; this difference was partly in their speeds of action. A third paper [**40** 38] showed that in contact action, the relative toxicity of small particles is increased by cooling the beetles after treatment. In tests by injection into milkweed bugs [*Oncopeltus fasciatus* (Dall.)], particle size seemed to have no effects on toxicity of rotenone and DDT suspensions if the bugs were kept warm after treatment. In cool bugs, colloid acted more quickly than crystals, but the kills from the two types finally became the same. The time for this to come about was less for DDT than for rotenone and less still for fluoro-DDT.

An explanation of these results is now given. In the action of contact poisons, attention is given to the waxy layer on the outside of the cuticle. Contact poisons must first of all dissolve in this wax layer, and it is suggested that the difference in action between rotenone and DDT is due to a difference in their solubilities in wax. Small particles will always have the advantages, over large, of greater surface area and greater ability to enter openings in the body. With *Oryzaephilus surinamensis*, a main route of entry by rotenone into the body is possibly through the spiracles, and this may be why colloidal rotenone is so much more toxic than rotenone crystals. The solubility of rotenone in wax is thought to be small and if this is so, it will be easy to saturate the wax and the higher solubility of very small particles of rotenone will be of importance. The behaviour of rotenone particles of different sizes is therefore understandable. Entry through the body openings is evidently unimportant for DDT, because large crystals kill as quickly as small ones. Penetration must be through the general cuticle. It is suggested that the solubility of DDT in wax is very high, compared with rotenone ; the wax will not be easily saturated by DDT and small particles will not have the advantage of higher solubility, which is only helpful if saturation is reached. It is shown theoretically that if solubility (in wax) does decide the relative behaviour of different-sized poison particles, then colloidal poison should be more toxic, relative to crystalline poison, if the insects are kept cool after treatment than if they are kept warm.

The following explanation is offered for the injection results. The blood of milkweed bugs contains free droplets of oil, and these are mainly responsible for carrying poison from injected crystals to the site of action. Colloidal poison probably diffuses there directly, and more quickly, in the aqueous phase of the blood. The difference in speeds of action of colloidal and crystalline poison will depend on the ratio of dose to solubility in oil. If this is large, saturation of the blood is easy, and small particles, with their special properties, act more quickly than large. If the ratio is small, the difference in speeds of action may not be detectable. This seemed to hold for the three poisons tested, but not by any means exactly. The ratios for rotenone, DDT and fluoro-DDT were in the expected order. Finally, it is suggested that in contact action, the relative speeds of kill of different-sized poison particles may be explained in a somewhat similar way, the solubility in cuticle wax, relative to the necessary dosage, being a controlling factor.

MARKE (D. J. B.) & LILLY (C. H.). **Smoke Generators for the Dispersion of Pesticides.**—*J. Sci. Fd Agric.* **2** no. 2 pp. 56–65, 7 figs., 41 refs. London, 1951.

The experiments described were carried out to develop mixtures reacting at relatively low temperatures for the generation of insecticidal smokes. In preliminary tests, BHC (benzene hexachloride) and DDT incorporated in pellets of a mixture of ammonium nitrate and potassium chromate, which react at about 350°C. on ignition, without flame or incandescence, gave 100 and 86 per cent. mortality, respectively, of house-flies (*Musca domestica* L.) exposed to deposits of the resulting smoke on paper, as compared with 0 and 0 in an inflaming mixture of potassium nitrate, sulphur and charcoal and 78 and 11 per cent. in a mixture of hexachloroethane, zinc oxide and calcium silicide of the incandescent smoke-producing type ; when the insecticides were dispersed (for comparison) from burning safety fuse, the percentages were 100 and 94.

Further tests of technical BHC (13–14 per cent. γ isomer) and technical DDT in a wide range of mixtures of ammonium nitrate and potassium chromate showed that increasing the content of potassium chromate favoured easy initiation of the reaction and allowed a larger proportion of insecticide to be introduced into the mixture ; the reaction temperature did not vary much with change in chromate content, but was lowered by increasing the proportion of insecticide. Only up to 10 per cent. DDT or 40 per cent. BHC could be used without incurring failure of initiation, but 50 per cent. of either could be introduced when mixtures of ammonium nitrate and ammonium dichromate were used as the heater component. In these mixtures, the reaction temperature tended to rise as the ammonium-dichromate content was increased, but the initiation could be improved and the reaction cooled by adding cuprous chloride. When the ammonium-dichromate content was raised above 15 per cent. in DDT mixtures, reaction temperatures up to 700°C. occurred, but such high temperatures were avoided by adding as little as 0·5 per cent. magnesium oxide, and it appeared that they might be due to the reaction of DDT itself, with liberation of hydrochloric acid. Similarly high percentages of insecticide could be incorporated in ammonium nitrate sensitised with charcoal or in guanidine nitrate or nitroguanidine sensitised with ammonium dichromate, and ammonium dichromate alone could disperse 20–40 per cent. insecticide at low reaction temperatures. The mixtures were mostly tested with BHC and DDT, but it was found that azobenzene and parathion could be dispersed by them ; the parathion was incorporated in an absorbent medium and then added to the heater mixture.

The toxicity of smoke deposits was tested by exposing glass plates for two hours on the floor of brick smoke-cells, in which the smokes were generated by remote control, and confining adults of *Tribolium castaneum* (Hbst.) on them for one hour ; 27–50 per cent. BHC in mixtures of ammonium nitrate with potassium chromate, ammonium dichromate or charcoal or of ammonium dichromate with guanidine nitrate or nitroguanidine gave comparable results (77–93 per cent. kill), and 45–50 per cent. DDT in mixtures of ammonium nitrate with charcoal or of ammonium dichromate with guanidine nitrate or nitroguanidine gave 96, 83 and 64 per cent., but 30 per cent. BHC in ammonium dichromate alone gave only 36 per cent. The deposit densities were found by exposing glass plates coated with wax on the floor for two hours during smoke deposition, washing the plates with benzene and determining the BHC by estimating the hydrolysable chlorine or the γ isomer by a polarographic method. A good statistical correlation was found between the density determinations and the insect kills, and the median lethal deposit of BHC from an ammonium-nitrate and potassium-chromate mixture was 12 mmg. per sq. cm. Exposing plates on the walls and ceiling showed that deposits were much lower there than on the floor, and the resulting kills of *T. castaneum* by BHC were only 8 per cent. as compared with 91 per cent. on the floor. Comparison of glass, cloth, glossy and ordinary wall-paper and smooth and rough fibreboard exposed in the smoke-cell showed that deposits on smooth surfaces generally gave higher kills than those on rough ones, and storage of the plates for 30 days that DDT deposits retained their toxicity on non-absorbent surfaces (glass) but lost it rapidly on absorbent ones (pressed board), whereas the toxicity of the BHC deposit was not markedly affected by the nature of the surface, but fell off steadily between the two extremes for DDT; the pure γ isomer was less persistent than the mixed isomers of BHC. The types and particle sizes of deposits from the different mixtures were investigated. Most of the particles deposited from mixtures of BHC, ammonium nitrate and potassium chromate were 6μ or more in diameter, and more than 90 per cent. of them were deposited in two hours. The DDT was deposited in the form of liquid drops that crystallised on being touched. Repeated exposure of insects to the same deposits on glass showed a rapid initial drop in toxicity for both substances, that for DDT being probably due to the difference in toxicity between the supercooled drops of the initial deposit and the crystals formed by exposure to the first insects, and that for BHC to its high vapour-pressure.

One of the advantages of the mixtures tested was the ease of initiation of the reaction ; they proved safe to manufacture and use, with no risk of explosion, and were appreciably more stable than chlorate mixtures during exposure to temperatures up to 120°C. Ways in which they can be prepared for use are briefly discussed.

READ (W. H.) & WAIN (R. L.). **The ovicidal Activity of some Phenyltrichloromethylcarbinols and their Esters towards Eggs of the Glasshouse Red Spider Mite** (*Tetranychus telarius* **L.**).—*J. Sci. Fd Agric.* **2** no. 5 pp. 204–207, 14 refs. London, 1951.

The results are given of tests of 18 phenyltrichloromethylcarbinols or esters of them against eggs of *Tetranychus telarius* (L.). Disks of pansy leaf bearing

30–80 eggs in all stages of development were submerged in suspensions of the test materials for ten seconds, drained, and kept for at least 14 days at a temperature of 19°C. [66·2°F.], after which observations were made for hatching. The only compounds showing appreciable ovicidal action were 4-chlorophenyltrichloromethylcarbinol and its acetate, but it was shown that the toxicity of phenyltrichloromethylcarbinol and its esters was increased by the introduction of chlorine and, to a smaller degree, of methyl into the para position of the ring, that the ovicidal activity of the carbinols was reduced by esterification, and that the 4-chlorobenzoates were apparently more toxic than the corresponding 4-nitrobenzoates, but less so than the acetates. It is concluded that none of the compounds tested would be of practical value as ovicides for the mite.

HARTLEY (G. S.), HEATH (D. F.), HULME (J. M.), POUND (D. W.) & WHITTAKER (M.). **Studies on commercial Octamethylpyrophosphoramide (Schradan). I. Composition and Analysis.**—*J. Sci. Fd Agric.* **2** no. 7 pp. 303–309, 20 refs. London, 1951.

DAVID (A.), HARTLEY (G. S.), HEATH (D. F.) & POUND (D. W.). **II. Determination of toxic Residues.**—*T.c.* pp. 310–314, 7 refs.

The following is based on the authors' summaries and conclusions. Descriptions are given in the first part of the paper of a method for the full analysis of the organic phosphorus compounds in commercial insecticidal products containing phosphoric acid dimethylamides, based on the different speeds of alkaline hydrolysis of the various compounds and differences in their partition coefficients. It was shown that the product Pestox III contains schradan (octamethyl pyrophosphoramide), a comparable amount of triphosphoric penta(dimethylamide) and smaller quantities of orthophosphoric acid trisdimethylamide and perdimethylamides of higher polyphosphoric and cyclic metaphosphoric acids, in addition to electrolyte impurities and residual solvents of manufacture. The properties of the various compounds as far as they affect analysis and stability are described, and some information on their interconversion on heating is recorded.

In the second part, a method of determining small traces of schradan in sprayed crops is described, and the validity of the method for assessing toxic risk to the consumer is discussed. The method is sensitive to 0·1 mg. insecticide per kg. plant tissue in the absence of interference from natural compounds, which may yield a " blank " value of up to 1 mg. per kg. Observations on the mammalian toxicity of the related compounds are recorded, and it is concluded that these are much less toxic than the pyroamide itself. The significance of the results obtained after spraying with commercial material (Pestox III) is discussed in the light of the composition of this product described in the first part of the paper and the toxicity observations recorded. It is concluded that the combined errors in the method cause the toxic residue to be somewhat overestimated.

VINCENT (D.), TRUHAUT (R.) & ABADIE (A.). **Contribution à l'étude du mécanisme de l'action toxique de l'insecticide D.D.T. D.D.T. et systèmes cholinestérasiques chez les animaux supérieurs et les insectes.**—*C.R. Soc. Biol.* **142** no. 23–24 pp. 1500–1502, 3 refs. Paris, 1949.

Previous work showed that DDT has no effect on the enzymatic hydrolysis of acetylcholine in the blood serum of horses and guineapigs [*R.A.E.*, A **38** 234], but since the cholinesterase of blood serum differs from that of red blood corpuscles and of muscular and nervous tissues in hydrolysing esters other than those of choline, the effect of DDT on cholinesterase activity in mammalian blood corpuscles and cerebral tissue was investigated. DDT added to a suspension of sheep brain and as an alcoholic solution to a simliar suspension of red blood corpuscles from a horse had no effect on cholinesterase activity in either case. It also had no effect on cholinesterase activity in *Musca domestica* L. or *Leptinotarsa decemlineata* (Say) when added as a powder or solution, respectively, to suspensions of the ground insects or on that of *M. domestica* when living house-flies were exposed to an atomised emulsion under a bell-jar [*cf.* **38** 233].

VAN DER GOOT (P.). **De import op Java van *Microbracon chinensis* Szep., een parasiet van boorderrupsen in het padi-gewas.** [The Introduction into Java of *M. chinensis*, a Parasite of Pyralid Rice-borer Larvae.]—*Meded. alg. Proefst. Landb.* no. 63, 12 pp., 7 refs. Buitenzorg, 1948. (With a Summary in English.) Also in *Landbouw* **20** no. 2. Buitenzorg, 1948.

Rice in Java is damaged by the borers, *Scirpophaga innotata* (Wlk.) and *Schoenobius bipunctifer* (Wlk.), which are the most injurious, and *Chilo suppressalis* (Wlk.) (*simplex* (Btlr.)) and *Sesamia inferens* (Wlk.), which are of little consequence, and sugar-cane by the tip-borer, *Scirpophaga intacta* Sn., and the stem-borers, *Proceras sacchariphagus* Bojer (*Diatraea striatalis* (Sn.)) and *Chilo* spp. Considerable control of all these species is given by egg-parasites, but parasites of the larvae are of little importance. As *C. suppressalis* on rice in China has many larval parasites, attempts were made to import some of the latter into Java in the hope that they would become established either on the rice-borers or on *Chilo* or *Proceras* on sugar-cane. The Ichneumonid, *Centeterus alternecoloratus* Cushm., was thought to be the most promising, and parasite pupae were accordingly collected in 1929–30 from rice stubble near Foochow, where that Ichneumonid is common, and were shipped to Java. Many parasites emerged in transit and died. A large proportion of the pupae gave rise to hyperparasites, none to *Centeterus* and some to *Bracon* (*Microbracon*) *chinensis* Szépl., which was the only living primary parasite obtained. This is an ectoparasite and it was reared in the laboratory on larvae of *Chilo* killed by immersion for 2½ minutes in water at 52·5°C. [126·5°F.]. The life-cycle in the laboratory at 25–30°C. [77–86°F.] normally lasted for an average of 15 days, but some of the pupae went into summer diapause for 3–9 months. The maximum number of eggs per female was 14 and the average 4, and the oviposition period averaged 12 days. Adults survived for an average of 15 days. In tests on alternative hosts, *B. chinensis* was successfully reared on *C. suppressalis*, *Sesamia inferens*, *Schoenobius bipunctifer*, *Pyrausta nubilalis* var. *salentialis* (Sn.) (maize-borer) and *Proceras sacchariphagus*, but not on *Scirpophaga innotata* or *S. intacta*. Small numbers were released in 1930 on sugar-cane or rice in five areas in which suitable hosts were present, but the results were unknown.

VAN DER GOOT (P.). **Biologische bestrijding van witte luis (*Phenacoccus iceryoides* Gr.) op koffie in de Toradja-landen (Zuid Celebes).** [The Biological Control of *P. iceryoides* on Coffee in the Toradja District (South Celebes).]—*Meded. alg. Proefst. Landb.* no. 64, 12 pp., 11 refs. Buitenzorg, 1948. (With a Summary in English.) Also in *Landbouw* **20** no. 3. Buitenzorg, 1948.

In 1926, about 50,000 coffee trees in the Toradja District, southern Celebes, were severely infested by a mealybug considered by the author to be *Phenacoccus iceryoides* Green, which covered the young shoots and undersides of the leaves. The upper surfaces of the leaves were covered with a sooty mould, which indicated that the mealybugs were not attended by ants. The geographical distribution of *P. iceryoides* is briefly discussed, and a list is given of other plants on which it was observed. Several natural enemies of *Icerya* spp. and Aphids were imported and tested against it with no success, but *Cryptolaemus montrouzieri* Muls., which was introduced from Java and released in 1928, quickly suppressed the outbreak. Up to 1943, only one further slight outbreak of the mealybug was reported, in 1930, and this was quickly controlled by the predator. From a brief review of other work on the use *C. montrouzieri* against mealybugs in Indonesia since its introduction in 1918 [*R.A.E.*, A **9** 324], it is concluded that this Coccinellid will prove successful only against species that are not attended by ants, or are attended only sporadically, and are present in sufficient numbers throughout the year.

PONTO (S. A. S.) & TJOA TJIEN MO. **De bestrijding van een slakrups, *Darna* (*Orthocraspeda*) *catenatus* (Sn.), op klapper in het Palu-dal.** [The Control of *D. catenata* on Coconut in the Palu Valley.]—*Landbouw* **22** pp. 69–81, 1 fig., 4 refs. Bogor, 1950. (With a Summary in English.)

In the past, *Darna* (*Orthocraspeda*) *catenata* (Sn.) has caused considerable damage to coconut in the Palu valley, on the north-west coast of Celebes [*cf. R.A.E.*, A **19** 174], where it was estimated that 100,000 trees were infested in 1935. Less severe damage has also been recorded on sago, oil palm [*Elaeis guineënsis*] and other palms. Infestation of coconut was heavy in the north of the valley, where rainfall is slight, but sporadic in the moister south. All stages of this Limacodid are briefly described. The eggs are laid on the undersides of the leaflets, and the young larvae feed on the lower surfaces of the leaves, skeletonising them, and older ones at the edges. Defoliation leads to loss of nuts, and the palms do not resume full production for 1½–2 years. Pupation occurs mostly on the underside of the leaves. In the laboratory at Menado, females laid about 30 eggs each, all on the day following emergence, and the egg, larval and pupal stages lasted 4, 24 and 10–14 days, respectively. The larvae are parasitised by *Euplectrus* sp. [*cf.* **29** 514] and *Apanteles* sp., and *Chaetexorista javana* Br. & Berg. [*cf.* **19** 174], *Ptychomyia remota* Aldr., *Chrysis* sp. and *Syntomosphyrum* sp. have been reared from the pupae. Parasitism among cocoons investigated in 1935 was 10 per cent., and 11 adults of *Chrysis* emerged from 161 cocoons in October 1946.

In investigations on control, a derris dust gave good results in 1936 but proved too expensive for general use, and the liberation of cocoons of *Apanteles* sp. from Menado in 1937 had no result. The best measure was cutting off and burning all but the 3–4 youngest leaves on palms showing infestations of 3 or more individuals per leaf, and a campaign of regular inspection and treatment was organised in 1937. This gave very satisfactory results, the number of palms requiring treatment falling from 15,626 in 1938 to 349 in 1941, though there was some recrudescence of infestation during the war years, when treatment was partly suspended. It was found that infestation spread from small centres in the north of the valley, and treatment of these gave widespread protection.

VAN DER GOOT (P.). **Twaalf jaren rijstboorderbestrijding door zaaitijdsregeling in West-Brebes (Res. Pekalongan).** [Twelve Years of Rice-borer Control by regulating the Time of Sowing in West Brebes (Central Java).]—*Meded. alg. Proefst. Landb.* no. 78, 32 pp., 2 figs., 8 refs. Buitenzorg, 1948. (With a Summary in English.) Also in *Landbouw* **20** pp. 465–494. Buitenzorg, 1948.

The author reviews the progress made in the control of *Scirpophaga innotata* (Wlk.) on rice in the West Brebes area of Java in the years 1929–41 by retarding the date of sowing, supplementing the information in earlier reports [*R.A.E.*, A **25** 452, etc.]. Further observations showed that the average time required for the development of one generation during the rainy season was 32 days. The maximum distance covered by the adults was about 8–11 miles, but apparently only females that had deposited all their eggs flew 10 or more miles. The percentages of egg-masses parasitised in seed-beds in the years 1930–37 by the three main parasites, *Telenomus* (*Phanurus*) *beneficiens* (Zehnt.), *Trichogramma japonicum* Ashm. and *Tetrastichus schoenobii* Ferrière, were 6–46, 0–28 and 0–2, respectively. The total combined parasitism averaged 30 per cent. The lack of overlap between generations of *S. innotata* is considered responsible for the fact that there was no tendency for parasitism to increase as the season advanced.

The effect of local rainfall in causing successive flights of moths after aestivation [*cf.* **25** 453] is shown on a diagram, and the advantages and disadvantages of delaying sowing until these flights are over, which protects the rice from infestation, and its effect on other crops are discussed. A special dispensation for early sowing to allow for a following sugar-cane crop was granted in some cases [*cf.* **25** 453], provided that all egg-clusters were hand-picked from the rice seedlings. Checking showed that the percentages of egg-clusters overlooked by the pickers were 10–25 in 1938, but they fell to 0·5–2 in later years. The effectiveness of the measure is shown by the great reduction in the numbers of moths taken in light-traps during the rainy season in the later years.

After 1930, severe borer damage occurred in only two seasons, in 1933–34, when sowing was apparently too early, and in 1937–38, when an outbreak occurred that was attributed to inadequate collection of eggs from the early seed-beds during the two previous years. It is concluded that the measures adopted have been successful, both economically and agriculturally.

VAN DER GOOT (P.). **Levenswijze van de gele rijstboorder.** [The Life-history of the Yellow Rice-borer.]—*Meded. alg. Proefst. Landb.* no. 79, 12 pp., 12 refs. Buitenzorg, 1948. (With a Summary in English.) Also in *Landbouw* **20** pp. 495–504. Buitenzorg, 1948.

Schoenobius bipunctifer (Wlk.) was formerly of minor importance as a pest of rice in the West Brebes region of Java, as it undergoes no aestivation period and can breed only in areas in which rice is grown throughout the year. Improvements in irrigation, however, have enabled a second crop to be cultivated in the dry season, with the result that *S. bipunctifer* has increased in numbers and has at times caused considerable damage. The numbers of egg-clusters collected per acre in the officially permitted early seed-beds [see preceding abstract] were 6,800 in 1932 and 16,000 in 1940–41. The egg, larval and pupal stages lasted 7–8, 25–30 and 8 days in the laboratory, but the interval between the peak flights of succeeding generations in the field was only about a month. There were 5–8 generations during the rainy season, and the adults were able to fly about 4–7 miles. The eggs are parasitised by *Telenomus* (*Phanurus*) *beneficiens* (Zehnt.), *Trichogramma japonicum* Ashm. and *Tetrastichus schoenobii* Ferrière, the percentages of egg-masses parasitised in seed-beds in 1933–41 being 13–30, 1–9 and 0–4, respectively. The total combined parasitism averaged about 30 per cent. The greater effectiveness of *Telenomus* is attributed to transport of the adults, themselves poor fliers, by females of *Schoenobius* [*cf. R.A.E.*, A **23** 560], and this is also thought responsible for the fact that the host population does not increase much during the season. Although it is not possible to delay the sowing of the wet-season crops until no adults of *Schoenobius* are present, the late sowing adopted against *Scirpophaga innotata* (Wlk.) [*cf.* preceding abstract] increases the interval between one crop and the next and is thus detrimental to *Schoenobius* also.

VAN DER LAAN (P.A.). **De mogelijkheden van bestrijding der rijstboorders.** [Possibilities of controlling Rice-borers.]—*Landbouw* **23** no. 7–9 pp. 295–356, 7 figs., 21 refs. Djakarta, 1951. (With Summaries in Indonesian and English.)

The author discusses, partly from the work of van der Goot and the other literature, the control of *Scirpophaga innotata* (Wlk.) and *Schoenobius bipunctifer* (Wlk.) on rice in Java by artificial means and their natural control by egg-parasites [*cf.* two preceding abstracts, etc.]. Late sowing has been successful against *Scirpophaga* only in the West Brebes region, and from a discussion of the conditions obtaining in other parts of the island, it is concluded that the method is applicable only in areas in which irrigation gives complete independence of rainfall, there is little danger of root rot, which is favoured by late sowing, sufficient labour is available to compensate for the ensuing shortening of the transplanting period, and the advantages to be gained by late sowing are not offset by a loss of secondary crops. Late planting out has also proved of value in experiments and can be practised by individual growers, but has not been adopted generally.

The eggs of both species are parasitised by *Telenomus* (*Phanurus*) *beneficiens* (Zehnt.), *Trichogramma japonicum* Ashm. and *Tetrastichus schoenobii* Ferrière. These give important control in some years, but are usually of limited value. Parasitism by them is difficult to estimate. When van der Goot's figures based on parasitised egg-masses of both species were revised to show the actual percentages of eggs parasitised at different periods, it was found that these usually varied between 10 and 35, though higher figures were obtained in some seasons. Numerous tests with contact insecticides against the newly hatched larvae were carried out in 1949 and 1950, two applications being made to seed-beds 13 and 20 days after sowing. In 1949, in an area in which both species were present, a spray of 0·125 per cent. toxaphene reduced the infestation from 20·3–25·8 per cent. for no treatment to 2·9–8 per cent. and proved superior to 0·04 and 0·07 per cent. DDT in suspension and emulsion sprays, respectively, or a derris spray, though all gave considerable reductions. It also proved much more effective than these and rather more effective than 0·05 per cent. technical BHC (benzene hexachloride) in tests in another area in which only *Schoenobius* occurred, but was inferior to 0·03 per cent. wettable parathion. Similar results were obtained in further tests in this area in 1950. Dusts proved inferior to sprays. When sprays were applied in the laboratory to parasitised egg-masses of *Schoenobius*, the percentages of living adults of *Telenomus*, *Trichogramma* and *Tetrastichus* that emerged, as compared with the controls, were 63, 88 and 61, respectively, for 0·07 per cent. DDT, 36, 63 and 37 for 0·125 per cent. toxaphene and 9, 0, and 10 for 0·015 per cent. parathion. In a further test, egg-masses laid in the laboratory were sprayed with the same materials, allowed to dry, and enclosed for a day with adult parasites. Parasitism by *Tetrastichus* was normal, that by *Trichogramma* was eliminated by parathion but not affected by DDT or toxaphene, and that by *Telenomus* was reduced to 28, 17 and 7 per cent. by DDT, toxaphene and parathion, respectively, as compared with 48 per cent. in the controls. It is concluded that chemical control in seed-beds is promising, but that parathion is too dangerous for practical use. Further field tests on a larger scale are planned.

[BALEVSKI (A.).] **Балевски (А.). Nouvelles possibilités dans la lutte chimique contre la pyrale** (*Sparganothis pilleriana*, **Schiff.**). [*In Bulgarian.*]—*Rev. Inst. Rech. sci.* **18** pt. 1 pp. 69–88, 1 fig., 9 refs. Sofia, 1950. (With Summaries in Russian and French.)

Sparganothis pilleriana (Schiff.), which was recorded as causing considerable damage to vines in Bulgaria for the first time in 1933, greatly increased in the

Province of Vidin in 1944 and reached outbreak numbers in 1945–46 over vineyards covering some 5½ sq. miles. Observations showed that there is one generation a year, the adults occurring from the end of May or beginning of June until about the beginning of August. They are active at night and shelter during the day under the leaves on the vines. The eggs are laid in batches on the lower surfaces of the leaves and hatch in about two weeks. The larvae descend on silken threads to the ground, without feeding, and spin cocoons under old loose bark on the vine stocks, in which they overwinter. They also occur under dry leaves and débris on the soil. In early spring, they migrate over a period of 10–15 days to the swelling buds at the tip of the shoots and feed on the young leaves. They later attack the fully developed leaves and young grapes, which they web together. They pupate in 40–45 days, and the pupal stage lasts 10–15 days. The vines are much weakened by the infestation, and the yield of grapes is reduced by 30–40 per cent.

In experiments in 1946–47 on control by means of insecticides, which it was hoped would prove more economical than collection and destruction of infested leaves, various winter sprays applied in March 1946 gave insufficient mortality, 4 per cent. sodium arsenate, which was the best, killing only 88·7 per cent. of the larvae in the laboratory and 91 per cent. in the field. In tests of summer treatments, several proprietary DDT dusts and sprays proved effective against the larvae in the laboratory, and when two field applications were made in May, a spray of 0·06 per cent. DDT (as Gesarol) gave 91·9 and 94 per cent. mortality in 1946 and 1947, respectively, a dust of 5 per cent. DDT (also as Gesarol) gave 99·4 and 99·1 per cent., and a spray of 0·05 per cent. and a dust of 5 per cent. DDT (both as Dedetan) gave 93·1 and 99·2 per cent., respectively, in 1947. A dust and a spray of benzene hexachloride were considerably less effective. Adults in the laboratory were very susceptible to contact with DDT.

[KHRISTOVA (E.).] **Христова (Е.). La mosaïque de la betterave en Bulgarie.** [*In Bulgarian.*]—*Rev. Inst. Rech. sci.* **18** pt. 1 pp. 89–100, 4 figs., 8 refs. Sofia, 1950. (With Summaries in Russian and French.)

In Bulgaria, a mosaic disease of sugar-beet, which was first recorded in 1933, now occurs in several districts in which this crop is cultivated and is particularly harmful to beet grown for seed, as it causes losses of up to half the yield. The symptoms of the disease are described, and an account is given of investigations on the properties of the virus and its host-range and mode of transmission. These showed that it resembles the virus of beet mosaic described by Hoggan [*R.A.E.*, A **21** 536] and Pound [**37** 128]. It was transmitted by abrasion to varieties of beet and spinach, several other chenopodiaceous plants and *Amarantus* spp., but not to cucurbits, beans or solanaceous plants. Transmission was readily effected in the greenhouse by *Aphis* (*Doralis*) *fabae* Scop. and *Myzus persicae* (Sulz.), after feeding periods of two days on infected plants, the incubation period lasting 11–14 days. It is suggested that the chief sources of infection in Bulgaria are second-year plantations of beet and certain weeds, mainly species of *Amarantus*, and that the chief vectors are *A. fabae* and *M. persicae.*

MUNRO (J. A.). **Drafting Insect " Soldiers " to War on Plant Parasites. How Parasites of the Sweet Clover Weevil and European Corn Borer are being established in North Dakota.**—*Bi-m. Bull. N. Dak. agric. Exp. Sta.* **13** no. 6 pp. 231–236, 3 figs., 1 ref. Fargo, N. Dak., 1951.

An account is given of recent attempts in North Dakota to establish parasites from Europe against *Sitona cylindricollis* Fhs. on sweet clover [*Melilotus*] and *Pyrausta nubilalis* (Hb.) on maize. Those released against *S. cylindricollis* were *Microctonus aethiops* (Nees) and *Campogaster exigua* (Mg.) from France [*cf. R.A.E.*, A **38** 206], where they were stated by H. L. Parker to have caused 4 and 20–50 per cent. mortality, respectively, among weevils collected in 1948. Consignments were received by air and liberations were made each year in 1948–50, totals of 524 of *Microctonus* and 1,348 of *Campogaster* being released. Small sowings of sweet clover were made on waste land at distances of up to about half a mile from the liberation sites to assist dispersion. Sweeping at intervals between 10th July and 30th August resulted in the recovery of three adults of *Campogaster*. Empty cocoons of *Microctonus* were found in 1949, but no adults were recovered in 1950.

As no parasitism was found among larvae of *P. nubilalis* collected in 1949 from ten places distributed throughout the State, parasite liberation was begun in 1950. A consignment of *Lydella stabulans* var. *grisescens* R.-D., *Angitia* (*Horogenes*) *punctoria* Roman, and *Macrocentrus gifuensis* Ashm. was received, and totals of 46, 38 and 638, respectively, were liberated in a heavily infested maize planting about two acres in extent surrounded by trees, at a time when most of the host larvae were in the second or third instar. No insecticides were employed on the plot, and the maize stalks were allowed to stand well into 1951 to permit the emergence of parasites. *A. punctoria* was the only species recovered from a collection of host larvae made at the end of October 1950, and 4·1 per cent. of the larvae were attacked by it.

MUNRO (J. A.), BRY (R. E.) & STEPHENSON (R. L.). **Weevil Larvae prey on Sweet Clover Rootlets.**—*Bi-m. Bull. N. Dak. agric. Exp. Sta.* **13** no. 6 p. 232. Fargo, N. Dak., 1951.

A preliminary experiment in North Dakota showed that larvae of *Sitona cylindricollis* Fhs. cause more damage to sweet clover [*Melilotus*] by feeding on the rootlets than is commonly thought [*cf. R.A.E.*, A **38** 205 ; **40** 88]. Eggs were scattered along two of four rows of plants grown from seed sown on 5th May in an out-door insect-proof cage, and the infested rows were surrounded by barriers of tar-paper extending about 6 ins. into the soil. On 27th July, the infested plants averaged 35·75 ins. in height and 1·5 oz. in weight, whereas the corresponding figures for those in the uninfested rows were 50 and 3·5.

SEVERIN (H. H. P.) & TOMPKINS (C. M.). **Aphid Transmission of a Mosaic Virus and Symptoms of other Virus Diseases of** *Primula obconica*.—*Hilgardia* **20** no. 15 pp. 279–288, 8 pls. (1 col.), 26 refs. Berkeley, Calif., 1950.

The symptoms of a mosaic disease that causes 5–25 per cent. loss of seedlings of *Primula obconica* in commercial greenhouses in San Francisco are described from experimentally infected plants. The incubation period lasted 18–26 days. In experiments, the virus was transmitted by *Myzus circumflexus* (Buckt.) and *M. ornatus* Laing, which breed on the plant in the greenhouses, and also by *Aphis apii* Theo., *A. ferruginea-striata* Essig, *A. gossypii* Glov., *A. fabae* Scop. (*rumicis*, auct.), *Brevicoryne brassicae* (L.), *Macrosiphum* (*Myzus*) *solani* (Kalt.) and *Macrosiphum pisum* (Harris) (*pisi* (Kalt.)) which do not. In tests with these nine species, previously noninfective unstarved Aphids, tested in groups of 20, transmitted the virus to ten of 120 healthy plants when fed on infected plants for one day and on healthy ones for two, and starved Aphids that fed on infected plants for 0·5–10 minutes and on healthy ones for two days transmitted it to 18 of 120, but only *A. gossypii* and *M. solani* transmitted in both tests. No transmission was effected by *Myzus persicae* (Sulz.), which also occurs on the plant in the greenhouses.

The symptoms of western cucumber mosaic, celery calico and common cucumber mosaic on the leaves of *P. obconica* are also described, with characters by which they can be distinguished, and notes are given on several other viruses that infect this or related species, including curly-top and California aster-yellows, which have been transmitted to *P. obconica* by *Circulifer tenellus* (Bak.) and *Macrosteles divisus* (Uhl.), respectively.

STEINHAUS (E. A.). **Possible Use of *Bacillus thuringiensis* Berliner as an Aid in the Biological Control of the Alfalfa Caterpillar.**—*Hilgardia* **20** no. 18 pp. 359–381, 12 figs., 35 refs. Berkeley, Calif., 1951.

The following is substantially the author's summary. The spore-forming bacterium, *Bacillus thuringiensis*, which is reported in the literature to be pathogenic for larvae of *Ephestia kuehniella* Zell. and *Pyrausta nubilalis* (Hb.) [*cf. R.A.E.*, A **19** 150, 155, 156, etc.], was found to produce a virulent infection in certain Californian insects, particularly *Colias eurytheme* Boisd., which attacks lucerne. Although *B. thuringiensis* is taxonomically a strain of *B. cereus*, the specific name is retained because of the distinct pathogenicity of this strain for insects and the lack of such pathogenicity of most other strains of *B. cereus*. In addition, 37 other strains of various well-known species of spore-forming bacteria were tested for their capacity to infect the larvae of *C. eurytheme*, *Prodenia praefica* Grote, *Phryganidia californica* Pack., *Peridroma saucia* Hb. (*margaritosae* (Haw.)) and *Junonia coenia* Hb., but only a strain of *B. thuringiensis* originally isolated from a diseased larva of *Aphomia gularis* (Zell.) exhibited any significant degree of pathogenicity. Larvae of *C. eurytheme* infected with *B. thuringiensis* showed the symptoms typical of most bacterial infections.

In preliminary tests in 1950 of the susceptibility of the insect under field conditions, spraying infested plots with suspensions of the spores reduced the larval population to below an economic level (20 larvae in two sweeps) in seven plots and to just above it in two within three days, whereas populations remained at a destructive level in untreated plots. Further tests are necessary before the use of *B. thuringiensis* can be recommended. It did not appear to suppress the population as consistently or to as low a point as the polyhedral disease [*cf.* **40** 62 etc.], but is effective in about two days, instead of 5–6, and leaves the integument of the insect intact, so that the dead larvae fall to the ground without soiling the lucerne.

HARTZELL (A.) & STORRS (E. E.). **Bioassay of Insecticide Spray Residues in processed Food.**—*Contrib. Boyce Thompson Inst.* **16** no. 2 pp. 47–53, 5 refs. Menasha, Wis., 1950.

The results are given of tests in which a bioassay method similar to that of Nolan & Wilcoxon [*R.A.E.*, A **39** 6] was used to detect various organic insecticides added in known quantities to processed foods (strained and bottled beans and mixtures of apples and apricots). The insecticides were extracted from the food products with benzene, this was evaporated, and the residues were redissolved in small amounts of acetone and added to water to make dilute solutions or emulsions. Larvae of *Aëdes aegypti* (L.) were placed in these and kept at about 30°C. [86°F.] for 24 hours, after which the percentage mortality was determined for each concentration of insecticide, and the breaking-point range of the toxicity curve, that is, the range of concentrations within which the kill fell from 100 to less than 80 per cent., was estimated. Comparative tests were carried out with extracts of foods to which a known amount of an insecticide had been added before processing, extracts of recently shaken mixtures of untreated foods and aqueous emulsions of known amounts of insecticide, and extracts of untreated food to which graduated amounts of a standard acetone solution of an insecticide were added after evaporating the benzene. The last were used as controls. When the apparent breaking-point range for the food to which the insecticide had been added before processing was very considerably higher than that for the control, it was clear that some destruction of the insecticide had occurred in the processed food.

Preliminary tests in which acetone solutions of 16 materials were shaken with water to make 1 : 1,000,000 solutions or emulsions, and these and further dilutions of them were tested against the mosquito larvae, showed that parathion was the most readily determined, giving complete mortality even at 0·0006 part per million, and that di(p-chlorophenoxy)methane, bis(p-chlorophenyl)-ethanol, dinitrocaprylphenylcrotonate and a 4 : 1 mixture of butoxypolypropylene glycol and Tergitol penetrant had such low toxicity to *A. aegypti* that they were unsuitable for testing by this method. Of the ten materials that were added to the food products, heptachlor [1 (or 3a), 4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-4,7-endomethanoindene], aldrin [1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-diendomethanonaphthalene], chlordan, 1,1-bis(p-chlorophenyl)-2-nitropropane, 1,1-bis(p-chlorophenyl)-2-nitrobutane, methoxy-DDT (methoxychlor), DDD (2,2-bis(p-chlorophenyl)-1,1-dichloroethane) and toxaphene were readily detected when added at 5 p.p.m., lindane [at least 99 per cent. γ benzene hexachloride] at 1 p.p.m. and dieldrin [1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-diendomethanonaphthalene] at 0·5 p.p.m. Extracts were diluted to 0·01–0·1 p.p.m. for critical assaying. Foods to which the insecticides had been added after processing and just before assay gave breaking-point ranges that did not differ greatly from those of the controls, whereas when the insecticides were added before processing, heptachlor underwent partial destruction in both beans and fruit and methoxy-DDT and chlordan in beans. Other substances extracted from the foods with the insecticides evidently reduced the toxicity of some materials, this being particularly marked for chlordan, DDD and toxaphene, and some were apparently themselves toxic.

FLEMION (F.) & OLSON (J.). *Lygus* **Bugs in Relation to Seed Production and Occurrence of Embryoless Seeds in various Umbelliferous Species.**—*Contrib. Boyce Thompson Inst.* **16** no. 2 pp. 39–46, 13 refs. Menasha, Wis., 1950.

In further tests in New York in 1949 on the destruction of the embryos in the seeds of umbelliferous crops, in which adults of *Lygus oblineatus* (Say), Pentatomids, *Diabrotica undecimpunctata* subsp. *howardi* Barber (*duodecimpunctata*, auct.) and *Systena hudsonias* (Forst.) were put in cages containing dill and fennel, with house-flies (*Musca domestica* L.) as pollinators but no other insects [*cf. R.A.E.*, A **39** 438], only *Lygus* destroyed the embryos, leaving the endosperm and fruit coat apparently normal, and this Mirid also destroyed the embryos in seeds of carrot, celery, coriander, parsley, parsnip and goutweed (*Aegopodium podagraria*). It was not determined whether other factors or insects could also destroy the embryos of seeds of this family, but it appears that *Lygus* bugs are primarily responsible for the natural occurrence of the damage. The destruction of the embryos was due to feeding when the endosperm was mature and the embryo still immature, but *L. oblineatus* also caused a total failure of dill and parsnip seeds when it was present during and immediately after flowering.

FLEMION (F.) & MACNEAR (B. T.). **Reduction of vegetative Growth and Seed Yield in Umbelliferous Plants by** *Lygus oblineatus*.—*Contrib. Boyce Thompson Inst.* **16** no. 6 pp. 279–283, 1 fig., 15 refs. Menasha, Wis., 1951.

When adults of *Lygus oblineatus* (Say) were caged with dill plants about six inches high in the laboratory, the terminal growing points and tips of some of the leaves were so injured that they wilted and died back within a few days; the insects were removed on the sixth or seventh day, and the plants recovered to some extent. When the Mirids were put in insect-free cages containing dill and fennel plants just about to flower, house-flies (*Musca domestica* L.) being introduced as pollinators during the flowering period, they injured the growing points of the main stem and branches and destroyed the flower buds, ovaries and umbels, and no mature seed was obtained. It appears, therefore, that *L. oblineatus*, in addition to destroying the embryos of apparently sound seeds of umbelliferous plants [see preceding abstract], can adversely affect plant development.

FLEMION (F.), WEED (R. M.) & MILLER (L. P.). **Deposition of P^{32} into Host Tissue through the Oral Secretions of** *Lygus oblineatus*.—*Contrib. Boyce Thompson Inst.* **16** no. 6 pp. 285–294, 2 figs., 22 refs. Menasha, Wis., 1951.

In attempts to determine whether *Lygus oblineatus* (Say) injects oral secretions into plant tissues during feeding, bugs were mede highly radioactive by allowing them to feed on 5 per cent. sucrose solution to which radioactive phosphorus had been added, and were allowed to feed a few days later on bean pods, which were subsequently tested for radioactivity. In the interval, they were maintained on sucrose solution without phosphorus and on bean pods for a few days, in order to allow time for the ingested phosphorus to be distributed throughout the body of the insect and thus become a component of any secretion transferred, to remove any radioactivity remaining on the outside of the mouthparts as a result of mechanical contact, and to accustom them to feed on bean tissue, which they did not readily do after feeding on sucrose solution. The insects fed on both the radioactive sucrose solution and the final bean pods through small holes in covers, so that only the mouthparts came in contact with the food, and they were watched throughout the final feeding and the pods discarded if excreta were observed near the feeding holes. The presence of radioactive phosphorus in the bean pods was determined by measuring the radioactivity by counting and through radioautographs. The bugs imparted radioactivity to the bean tissue in many instances. The amount imparted was not always greater after longer feeding periods, and when the same insect was used for several days, the amount of radioactivity in the host tissue was often greater on a given day than for an earlier feeding period, suggesting that the radioactivity transferred was the result of oral secretions and not merely a mechanical transfer of original radioactive material remaining on the mouth parts. The latter is also improbable because radioactivity was transferred as late as 11 days after the insects had been removed from the radioactive solution.

BIRK (L. A.) & OUGHTON (J. G.). **Parathion Residues on Swede Turnips.**—*Sci. Agric.* **32** no. 1 pp. 52–56, 4 refs. Ottawa, 1952.

Rhopalosiphum pseudobrassicae (Davis) was a serious pest of swedes in Ontario in 1949. Parathion has been shown to be very effective against it [*cf. R.A.E.*, A **38** 114], and since swedes for table use are an important crop locally, investigations were carried out in 1949 and 1950 on the residues likely to be present at harvest on treated plants.

The following is based almost entirely on the authors' summary of the work. A wettable powder containing 15 per cent. parathion was applied in sprays at 1 lb. per acre (the rate commonly recommended against *R. pseudobrassicae*) and at heavier rates weekly or fortnightly for periods of 2–8 weeks. Samples were taken 1–4 weeks after the last application, and extracts of the foliage, peel and pulp were analysed.

Low residues were found on peel and leaves and none in pulp, even when abnormally heavy applications of the insecticide had been made. In 1949, four applications of 1 lb. powder per acre made weekly resulted in a residue on peel of 0·21 part per million nine days after the last treatment. In 1950, similar applications made fortnightly resulted in residues of 0·1 p.p.m. on peel and 0·02 p.p.m. on foliage eight days after the last treatment. When four applications of 5 lb. wettable powder per acre were made, the corresponding residues on peel and foliage were both 0·21 p.p.m. In 1949, two applications of 10 lb. wettable powder nine days apart resulted in a residue of 1·21 p.p.m. on peel nine days after the second treatment. Residues decreased quite rapidly as the period following applications increased. Had the leaves been fed to dairy cows, the amounts of parathion ingested would have been much less than those that have proved harmless to such animals and have not contaminated their milk.

MacVicar (R. M.), Braun (E.), Gibson (D. R.) & Jamieson (C. A.). **Studies in Red Clover Seed Production.**—*Sci. Agric.* **32** no. 2 pp. 67–80, 15 refs. Ottawa, 1952.

An account is given of investigations in the Ottawa area in 1950 on the production of red-clover seed, with special reference to the control of injurious insects, pollination and the secretion of nectar. The injurious insects present on the first-growth clover were *Cydia* (*Grapholitha*) *interstinctana* (Clem.), *Tychius stephensi* Schönh. (*griseus* Schaeffer), *Hypera meles* (F.) and *Aceratagallia sanguinolenta* (Prov.), and a survey made on second-growth clover before spraying showed substantial numbers of *T. stephensi*, *Sitona hispidulus* (F.) and *Melanoplus* spp. The treatments tested comprised 1·5 lb. DDT per acre applied before flowering, alone or followed by 1·5 lb. toxaphene or methoxy-DDT (methoxychlor) at full bloom, and a combined spray of 1·5 lb. DDT and 1·5 lb. toxaphene per acre before flowering. The second treatment increased the seed yield by 25 per cent. and the first and fourth also gave significant increases. When *Melanoplus* spp. were controlled with toxaphene, seed yields were increased by 18 per cent. The insecticides did not appear to cause abnormal mortality among pollinating insects, which chiefly comprised honey bees.

Andison (H.) & Cram (W. T.). **Narcissus Bulb Fly Control with Methyl Bromide Fumigation and its Effect on the Flower Production of Greenhouse-grown Narcissus Bulbs.**—*Sci. Agric.* **32** no. 2 pp. 93–98, 1 pl., 16 refs. Ottawa, 1952.

The following is almost entirely the authors' summary. During 1949 and 1950, experiments were carried out in British Columbia on the control of larvae of *Merodon* (*Lampetia*) *equestris* (F.) on bulbs of *Narcissus* by fumigation with methyl bromide and the effect of the fumigant on the flower production of greenhouse-forced bulbs. There was a wide margin of safety between treatments that gave complete mortality of the larvae and those that injured the bulbs. Fumigation with 3 lb. methyl bromide per 1,000 cu. ft. for 4½ hours at 60°F. (the mean monthly temperature at digging time) gave as high mortality of the larvae as the standard treatment of 3 lb. for 4 hours at 70°F. recommended in the western United States [*cf. R.A.E.*, A **31** 16]. Hence the installation of expensive electrical heating equipment, which is essential if a temperature of 70°F. is to be maintained in bulb fumigation chambers, is not necessary for satisfactory control. Differences in flower production were not apparent between untreated King Alfred bulbs and those treated at the excessive rates of 5 lb. for 2½ hours and 3 lb. for 8 or 12 hours at 60°F. Also, no differences were observed when three other varieties were treated at 3 lb. for 8 hours at 60°F. King Alfred bulbs that were fumigated twice at an interval of 2 days with methyl bromide at 3 lb. for 4½ hours at 60°F. showed no apparent differences in growth. The flowering dates were the same for treated and untreated bulbs. However, fumigation with 3 lb. for 24 hours at 60°F. rendered King Alfred bulbs useless for flower production.

MORRIS (R. F.). **Frass-drop Measurement in Studies of the European Spruce Sawfly.**—*Bull. Sch. For. Mich.* no. 12, 58 pp., 1 pl., 7 graphs, 35 refs. Ann Arbor, Mich., 1949.

Since insects that are destructive in forests in North America must usually be controlled by indirect methods, the application of which depends on the fluctuations in insect numbers and the factors that influence them, it is desirable to obtain reliable quantitative data on insect populations. During the serious outbreak of *Gilpinia hercyniae* (Htg.) on spruce in eastern Canada [*cf. R.A.E.*, A **40** 33, etc.], the author studied a method of obtaining these by measuring the amount of frass falling from the trees during the period of larval feeding [*cf.* **19** 702 ; **22** 627]. He describes it in some detail and discusses its uses and the principal sources of error in measurement (lodging of frass in the trees and the presence of frass of other species). As it involves no disturbance to the larvae themselves, the same trees can be used continuously, thus eliminating a major source of variation. He also gives a short account of the life-history of *G. hercyniae* and describes its frass pellets, which can be distinguished from those of other insects [*cf.* **31** 173] and the size of which is indicative of instar.

Observations were made in most years between 1938 and 1946, mainly on a permanent plot in New Brunswick, and showed the effect of the virus disease of the larvae that became prevalent in the summer of 1939 and was the principal factor responsible for the decline of the outbreak [*cf.* **33** 398 ; **36** 207–208]. Trees of black spruce (*Picea mariana*) were selected for measurements of frass drop, and trays 2 ft. square were placed under them in exactly the same positions each spring. The frass was usually collected and measured weekly. Volume was found to be more reliable than weight for this, as it was not affected by moisture or by air-drying. Frass yield, or the amount of frass ejected by a larva in a given period of time, was determined by rearing larvae individually from hatching to the end of the fifth instar, and as the amounts involved were too small to be measured by volume, a conversion factor between volume and weight was found. In order to establish the relation between frass yield and foliage consumption the needles on the twigs on which these larvae were reared were counted at the beginning and end of each larval instar, and samples of the needles were dried and weighed. Since the rate of larval feeding and, consequently, of frass drop is influenced by meteorological factors, adequate records of these were obtained.

In 1939, when the initially high larval population was greatly reduced by the disease, a significant positive correlation was found between the initial frass drop and the degree of reduction that had taken place on the same trees up to the end of August, indicating a positive relation between mortality from the disease, the density of the larval population and the existence of a limit of population density below which the disease effected no further reduction [*cf.* **33** 399]. The most general use of frass-drop measurements, however, is for comparison of the amounts of feeding in different years, in different periods of the same season, on different trees, in stands of different types and before and after the application of control measures.

It is considered that frass-drop measurements alone, without detailed data on frass yield, should prove useful in connection with studies of silviculture, food-plant preferences, tree-type preferences, natural and applied control and forest-insect surveys. If concurrent data are obtained on the drop of larvae into the trays, these can be used in conjunction with frass drop to calculate larval mortality. By the use of a coefficient of food assimilation, the amount of foliage consumed by an insect can be estimated from frass-drop measurements ; the results must be increased according to the proportion of foliage destroyed but uneaten in order to represent the total injury to the food-plant. Some improvements in the method are suggested.

BERGOLD (G. H.). **The polyhedral Disease of the Spruce Budworm, *Choristoneura fumiferana* (Clem.) (Lepidoptera : Tortricidae).**—*Canad. J. Zool.* **29** no. 1 pp. 17–23, 3 pls., 1 graph, 18 refs. Ottawa, 1951.

Attempts were made in Canada to infect larvae of the form of *Choristoneura fumiferana* (Clem.) that feeds on spruce and balsam fir [*Abies balsamea*] with a capsule virus disease (granulosis) [*cf. R.A.E.*, A **38** 348] that was found heavily infecting the closely related *Tortrix* (*Cacoecia*) *murinana* Hb. in Europe in 1948. Direct transfer by feeding on purified capsules and injection of liberated free virus rods did not cause mortality, but induced symptoms of a latent polyhedral disease. As the latter was also noted in dead larvae collected from various parts of Ontario, studies on it were begun, using a stock originating from larvae collected in Ontario that was reared in the laboratory for three generations and found to harbour latent infection with a microsporidian and with both a capsule and a polyhedral virus disease. The methods adopted for purifying the polyhedral bodies, isolating the virus, and infecting the larvae are described, and descriptions and preliminary chemical analyses are also given of the polyhedral bodies and virus rods [*loc. cit.*].

When heavy doses of a polyhedral suspension were applied as droplets to the mouthparts of the larvae or sprayed on to their food, only about 6 per cent. completed their development ; many of those infected during the ten days prior to pupation gave rise to adults, since the development of the disease almost ceased during pupation. When the larvae were kept at 22°C. [71·6°F.], they succumbed about ten days after infection. By injecting suspensions of purified virus into larvae in the early fourth instar and disregarding all those that failed to complete their development or to exhibit typical symptoms of the disease, the median lethal dose of virus particles was found to be about $1{\cdot}5 - 3{\cdot}6 \times 10^{-9}$ gm., which is unusually high.

In a discussion of the effectiveness of the disease in nature, it is stated that the low virulence shown by it in the laboratory is probably due to immunity conferred by previous sublethal infection. Furthermore, since the feeding period of healthy larvae is rather short, they have little opportunity to become infected by contact sufficiently early in their development for the disease to be lethal. If the disease is transmitted through the eggs [*cf.* **40** 11], larvae so infected would die in the second instar before leaving their webs and so have no opportunity to infect other larvae by contact.

Harvey (G. T.) & Brown (A. W. A.). **The Effect of Insecticides on the Rate of Oxygen Consumption in** *Blattella*.—*Canad. J. Zool.* **29** no. 1 pp. 42–53, 8 graphs, 14 refs. Ottawa, 1951.

The following is based on the authors' summary. The effect of 26 insecticides on the rate of oxygen consumption of *Blattella germanica* (L.) was ascertained by injecting them in solution into adult males at approximately the median lethal dosage. DDT, methoxy-DDT (methoxychlor), lindane [containing at least 99 per cent. γ benzene hexachloride], toxaphene, chlordan, its α- and β-isomers, heptachlor [1(or 3a),4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-4,7-endomethanoindene], aldrin [1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8 - diendomethanonaphthalene], dieldrin [1,2,3,4,10,10 - hexachloro - 6,7 - epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-diendomethanonaphthalene], dinitro-o-cresol, dinitro-o-cyclohexylphenol, the triethanolamine salt of dinitro-o-sec.-butylphenol, pyrethrins, nicotine, azobenzene, tetraethyl pyrophosphate, parathion, p-dichlorobenzene and β,β′-dichlorodiethyl ether had a pronounced stimulating effect on oxygen consumption. With the chlordans, heptachlor, aldrin and dieldrin, this effect was preceded by a long latent period. Extracts of *Ryania* and rotenone (from derris) were depressant after a slight initial increase in the rate of respiration, and an extract of sabadilla gave a slight rise, but was not depressant. Phenothiazine had little or no effect, and two thiocyanates were entirely depressant. Similar results were obtained by spray applications of the insecticides.

Orser (W. B.) & Brown (A. W. A.). **The Effect of Insecticides on the Heart-beat of** *Periplaneta*.—*Canad. J. Zool.* **29** no. 1 pp. 54–64, 5 graphs, 9 refs. Ottawa, 1951.

The following is based on the authors' summary. The effect of nine insecticides on the rate of heart-beat of *Periplaneta americana* (L.) was ascertained by injecting them into adult males at a dose of 80 mmg. per individual, corresponding to 100 mmg. per gm. body weight. DDT, lindane [at least 99 per cent. γ benzene hexachloride], chlordan and toxaphene had little effect, the maximum response being a slight acceleration. Dinitro-o-cresol and dinitro-o-cyclohexylphenol caused an increase in rate, followed by total failure of the heart. Parathion and thiocyanoethyl laurate proved to be slightly stimulatory in the concentrations employed. Rotenone steadily depressed the rate of heart-beat until it stopped. Similar effects were produced by applying the insecticides in a contact spray in a mixture of benzene and kerosene, although the solvent caused an initial drop in heart rate that was probably associated with temporary narcosis. The heart of decapitated insects showed a gradual decrease in pulsation rate and was less sensitive to the effects of insecticides.

PAPERS NOTICED BY TITLE ONLY.

Sarles (M. P.), Dove (W. E.) & Moore (D. H.). **Acute Toxicity and Irritation Tests on Animals with the new Insecticide, Piperonyl Butoxide.**—*Amer. J. trop. Med.* **29** no. 1 pp. 151–166, 8 refs. Baltimore, Md., 1949. [See *R.A.E.*, B **40** 86.]

Liste officielle des noms français des insectes d'importance économique au Canada [including French, English and scientific names]. **(Préparée par le Comité permanent des noms français de la Société de Québec pour la Protection des Plantes. Publiée en supplément du rapport annuel de cette Société pour l'année 1951.)**—2nd edn., 73 pp. Quebec, Minist. Agric., 1952. [*Cf. R.A.E.*, A **37** 320.]